RIAL AND COMMERCIAL GEOGRAPHY

BY

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PREFACE

ok aims to interpret the earth in terms of its usefulness ity. Since the primary interest is humanity rather s of the earth's surface, the book deals with human as affected by the earth, rather than with parts of the ney affect human activities.

ss of facts pressing upon geographers is so great that discussion, as distinguished from description, is always and this space is still further reduced by the repeti- lved in the usual regional arrangement of matter. That on why I have employed, in the first part of this book, ative arrangement by industries. The wheat industry, le, proceeds from certain environmental conditions and very continent. Its treatment as a unit brings causes s together in their explanatory relation and makes the only appeal to the reason but also grip the memory. nspectus of the world industries, when properly illus- charts and diagrams, should give a sound knowledge de activities of each country, without sacrificing the luable knowledge of the industries themselves.

second part of the book there is an attempt to increase rce this regional knowledge by a description of the com- he world. Here the great ports of traffic are considered geographic and economic reasons for their greatness . The description of the principal trade routes and the that passes over them is still another means of making us countries of the world stand out in the mind of the their commercial individuality. I believe this method esults that cannot be attained in the same space by the al method of presentation.

preparation of this book, I am greatly indebted to Walter S. Tower, of Chicago. It is impossible for me te the influence that he has had upon it through years y conference and cogent criticism. He has also rendered

me the very great service of carefully reading the manuscript and suggesting innumerable changes. My associates, Messrs. George B. Roorbach and Joseph H. Willits, have also critically read the manuscript. All three of these gentlemen are, however, absolved from any responsibility for the final errors of fact and of style, for after their work was done, I spent months in working the book over and in adding illustrative data. Mr. Willits prepared the alphabetical index, and he and Mr. Alfred G. White assisted me in the preparation of the statistical diagrams.

I also wish to express my appreciation of the counsel given me by Professors Wesley N. Clifford and Calvin O. Althouse, of Philadelphia. The unending willingness of the numerous scientific writers of the U. S. Dept. of Agriculture places me under great obligation. It is a pleasure also to recall the cheerful aid given me by the Philadelphia Museum.

J. Russell Smith.

Wharton School of Finance and Commerce,
University of Pennsylvania,
March 7, 1913.

ADDENDA

The acknowledgment of the source of Figures 4, 16, 17, 20, 22, 23, 36, 37, 108, 117, 125, 136, 142, 147, 151, 163, 197, 204, should read: "From Salisbury, Barrows and Tower's Elements of Geography."

By inadvertence the same acknowledgment was omitted from Figures 95 and 215.

CONTENTS

BIBLIOGRAPHY

GENERAL REFERENCES

f industry which this book aims in part to explain and inter-
second decade of the Twentieth Century, undergoing changes
speed than ever before. Some users of this book may wish
bring down to the moment their knowledge of particular
d here. For their aid, brief bibliographic direction is given,
ends of the various chapters and partly in the immediately
graphs:

REFERENCES FOR PART I OF THIS BOOK

LTURE.—The U. S. Department of Agriculture, Washington,
ch valuable information about the agricultural industries of
ates and other countries. See its "Yearbook" and "List of
" both of which are to be had without cost. Persons wishing
of current agricultural statistics should by all means have a
"Yearbook," which has a very complete collection. "The
r" issued monthly by the Department also has many valu-
tions and comparisons.

lopedia of American Agriculture, by Bailey, is a valuable
k. "The Country Gentleman," Philadelphia, may be men-
urnal aiming to cover the whole field of agriculture. Numer-
al journals discuss the various phases of agriculture, thus:
ds Dairyman"—Dairying, Janesville, Wis.
ders Gazette"—All animal Industries, Chicago.
Fruit Grower"—St. Joseph, Mo.
r Fruit"—Hood River, Ore.
voted to certain regions, thus:
l New Yorker"—New York.
ornia Cultivator"—Los Angeles.
iana Planter"—New Orleans.
Iowa Farmer"—Des Moines.
ional Institute of Agriculture, Rome, has valuable publica-
ne who scans for a few months the U. S. Daily Consular Re-
himself in a veritable shower of information covering the whole
ook, and valuable in supplementary work.

FACTURING.—Persons desiring detailed or current information
industries are especially recommended to consult the more
journals, of which the following are suggested as a partial list.

Subject	*Name of Journal*	*Where Published*
Canning	American Grocer	New York
Cane Sugar	International Sugar	Manchester
Beet Sugar	American Sugar Journal	Chicago
Spices	Tea and Coffee Journal	New York
Coffee	Tea and Coffee Journal	New York
Tea	Tea and Coffee Journal	New York
Cocoa	Tea and Coffee Journal	New York
Fisheries	Fishing Gazette	New York
Iron	Iron Age	New York
Coal	Black Diamond Coal Age	Chicago New York
Petroleum	Petroleum Review	London
Lumber	American Lumbermen	Chicago
General Textile	Textile World Record	Boston
Cotton Trade and Manufacture	American Wool and Cotton Reporter	Boston
Wool Trade and Manufacture	American Wool and Cotton Reporter	Boston
Leather	Shoe and Leather Report Shoe and Leather Facts	Boston Philadelphia
Tanning	Hides and Leather	Chicago
Rubber Manufacturing	India Rubber World	New York
Rubber Growing	India Rubber World	New York
Machinery Trade and Manufacture	American Machinist	New York
Jewelry	American Jeweler	New York
Chemical Industries	Pharmaceutical Era Chemical Trade Review	New York Philadelphia
Fertilizer Industry	American Fertilizer	Philadelphia
Coal Tar and Dye Stuffs	Paint, Oil, and Dye Review	Chicago
Vegetable Oils and Extracts	Paint, Oil, and Dye Review	Chicago
Soaps	Soap Gazette and Perfume Journal	New York
Mining and Mineral Industries	Engineering and Mining Journal Mines and Minerals	New York Scranton
Cement	Cement	New York
Pottery and Porcelain.	Glass and Pottery World	Chicago

The Commercial Museum of Philadelphia publishes "Commercial America," a monthly journal containing many valuable presentations of statistics, usually of manufactures and commerce, but occasionally of agriculture

ɪʟ.—Of especial value in the field of this book are "The Ameri-
ɔf Reviews," "The Worlds Work," "The Technical World
It should be noted that geographic, industrial and economic
gaining a rapidly increasing share of space in many periodic
The contents of nearly 400 leading periodicals are indexed in
ılative Index of periodic literature, and in the Engineering
search through these indexes will give a wealth of titles on the
by this book.

PART I

INDUSTRIAL GEOGRAPHY

PART I
INDUSTRIAL GEOGRAPHY

CHAPTER I

OUR CHANGING ENVIRONMENT

1. THE VALUE OF LANDS TO MAN

ıf people can only prosper, increase and grow powerful environment furnishes them an abundance of food terials for making appliances to supply the other of existence.

them as we may, we find that every want of man, skimo or banker, is a desire for one of these six goods: food, clothes, house or shelter, fuel, luxuries, nd materials of industry which enable him to produce the others. So nearly universal are these wants cally all men have all six classes of goods. Even ve luxuries in the form of toys, ornaments, and truments.

materials for a living come directly or indirectly soil or crust of the earth. The man in a ship at sea el sky-scraper in a modern city gets his sustenance il just as surely as does the farmer who takes potatoes urrow. Each particular method by which a man useful commodity leads to an industry often of world-ibution. To understand the way the human race arth into its home, we have but to study the various by which groups of men achieve their living.

timately depending upon the contents of the earth's t of our living comes indirectly through the inter-ages of plant and animal life, the crust itself supplying it a small part of our wants. In and upon the earth ispensable water without which we would promptly Vhile the more solid substances of the earth's crust irectly available and of great value, as salt, building d metals, we depend chiefly upon vegetation for our The plants grow from the soil. We eat them or

clothe ourselves with their fibers, cut them into pieces, shape them into tools, and build our houses and barns, extract their juices and dig their roots for drugs and medicines. We burn them for fuel, shape them into articles of luxury, and thus make them help in the supply of some of the wants of each of the six classes. The animals in turn eat the plants and each other, and furnish us their meat and milk as nourishment; their wool and furs become our clothing, their tougher hides make our shoe leather, the tents of the nomad, and the belts of the engine wheel, while the cultural services are hinted by the soft leather bindings of our choicest books.

The environment upon which we depend, then, and which supplies our six wants is, in a broad sense, land. From our human standpoint, a country is good or bad in accordance with the good or bad manner in which it supplies these six wants. The most important exception to this is the influence upon man of the climate, which sometimes turns into an empty Eden what would otherwise be an economic paradise.

To an extent little appreciated, the environment makes the race. It is a common mistake of the historian to give the idea that peoples have certain qualities inherently. It is much more correct to say that primitive or savage peoples are primitive or savage because of the niggardliness or peculiarities of nature's gifts to the land in which they happen to live, and not because of bad qualities which they may inherently possess. The environment, in making the race, has given the qualities. The Eskimo upon the bleak, windy, treeless, bitter-cold shore of the Arctic Sea, in a climate where he constantly faces the danger of freezing and starving and where he, therefore, needs much protection from the cold in the form of fuel, clothes, house or food, has almost nothing with which to build houses, make clothes, or prepare food. Accordingly, the population is exceedingly sparse and can support itself only along the seacoast where the few advantages of the land may be combined with the more numerous advantages of the sea with its fish and seals. Shall the Eskimo be dismissed as a barbarian or praised as a master of a ferocious environment? In winning a living from such meager and almost exclusively animal sources the Eskimo has shown great ingenuity. Even the kyak or canoe, the most

his implements of industry, is made of bones and
s bound together with sinews and rawhide thongs,
hance the ocean currents bring a little drift wood
For fuel, with which they cook their food but do
ıeir houses, they use the fat of seal, walrus or whale
Yet the Eskimo himself is not a bad, weak, or stupid
s many fine qualities are highly praised by explorers.
; put to school he has shown that he can learn with
us. The severity and poverty of his environment
economic progress impossible.

Dependent on One Resource.—Other peoples have
n living in countries with almost as few natural aids
ssessed by the Eskimo, but culture has been held in
ıe South Sea Islander has lived on coral islands a few
the waves, where his resources, were limited to the
alm upon the strand and fish that came from the sea.
hese limited resources he has managed to keep strong
y and fill in some manner all his needs. When he
aw, he got it by fastening shark's teeth into a piece
His other equipment was made by equally ingenious

e plains of central Asia people have for ages lived in a
the one resource was grass. Flocks of sheep, cows,
ıts and camels fed upon the grass. The herdsmen
horses followed the flocks as they roamed the flat
earch of grass. These people were nomads because
o go wherever they could find grass. Their diet was
se, and meat, and wheat obtained by barter at some
r clothing, wool and skins; their shelter, a felt or
t stretched over a few precious poles which they had
h them for hundreds of miles from the banks of some
stream. Burning cow dung made the fire. A little
bought from trading caravans.

NCE OF CLIMATE IN THE ORIGIN OF CIVILIZATION

ion is a product of adversity. The great civilizations
seem to have arisen where nature made production
ly a part of the year, and thus made it necessary for

man to work and save up for the time when he could not produce. Man does not naturally like to work steadily, and if nature enables him to avoid it he usually seems content to loaf rather than labor and progress. Accordingly, there have been no great civilizations in the warm, moist parts of the torrid zone, where nature does the most to make easy the support of life. Man's wants there are so easily met and the climate is so enervating that he does not get the habit of work or become ambitious. The

FIG. 1.—The Jamaica negro finds life in the tropics to be easy. (Hamburg American S. S. Co.)

climate is continually warm, and the rainfall is sufficiently regular over vast areas to keep vegetation always green and growing. The native of Jamaica, or Cuba, or central Africa, or the Philippines, or the East Indies can build himself a little shelter of palm leaves to keep off the rain; the warm climate removes the need of further shelter or many clothes. A few banana plants by the hut, and a little patch of sweet potatoes will live and yield for years, for there is no frost to kill the plants. The forest is full of nuts and wild fruit and game; the streams are alive with fish, a variety

southern Asia burying themselves in the mud, where caught with the bare hand. Wood in abundance little fuel he needs for cooking, and if he would make um or any other simple luxury, the raw materials lie at his hand in great abundance. Accordingly, these regions may sit and doze most of the time, as, enerations, his ancestors have done before him—en- lenty.

ence of Tropic Abundance.—This abundance with- es not require or induce the work habit. For this of perennial plenty have never been lands of lands of perennial plenty therefore fall prey to the ous peoples from the lands of alternating scarcity in the temperate zone. Thus nearly all of Africa rt of Asia within the tropics have been taken as the peoples of Europe. The only absolutely in- erritory in all Africa is Abyssinia, where the cool high plateau stimulates the people into a vigor and has enabled them, with the aid of a powerful otect themselves from annexation.

starvation, man will work. Civilizations have this annual threat of nature was followed by con- itting fruitful harvests. If fruitful harvest is fol- stimulus of frost we have the best conditions for ent of energetic races.

summer, the growing season, our winter's frost and eath or hibernation to the whole vegetable kingdom, an to the protection of house and warm clothing. ates we must either starve, eat wild animals, or eat e saved by our work during the summer. Therefore ced. A similar but less severe climatic goad to man's rnished by climates that are alternately productive ductive through variations in the rainfall. The tions in the world's history had their empires in the e Euphrates and the Nile, where a fertile soil and a re supply made great crops followed by blistering ind of warm winter so far as food production was Thus Babylon and Nineveh were rich and cultured ne when all Europe lay in barbarism, and the pyra-

mids were built before the drought-driven Joseph went down t Egypt. These valleys got their early start because their advan tages as the home of man were almost unrivalled. They had : warm climate, fertile soil, and a protected location. Each yea the rivers overflowed, fertilizing the soil with the muddy water and promoting the growth of a crop by irrigation. The surplu of food to last through the dry season naturally produced th habit of working and saving, and resulted in a sufficient surplu of goods to support life while attention was given to learning and the things we call civilization.

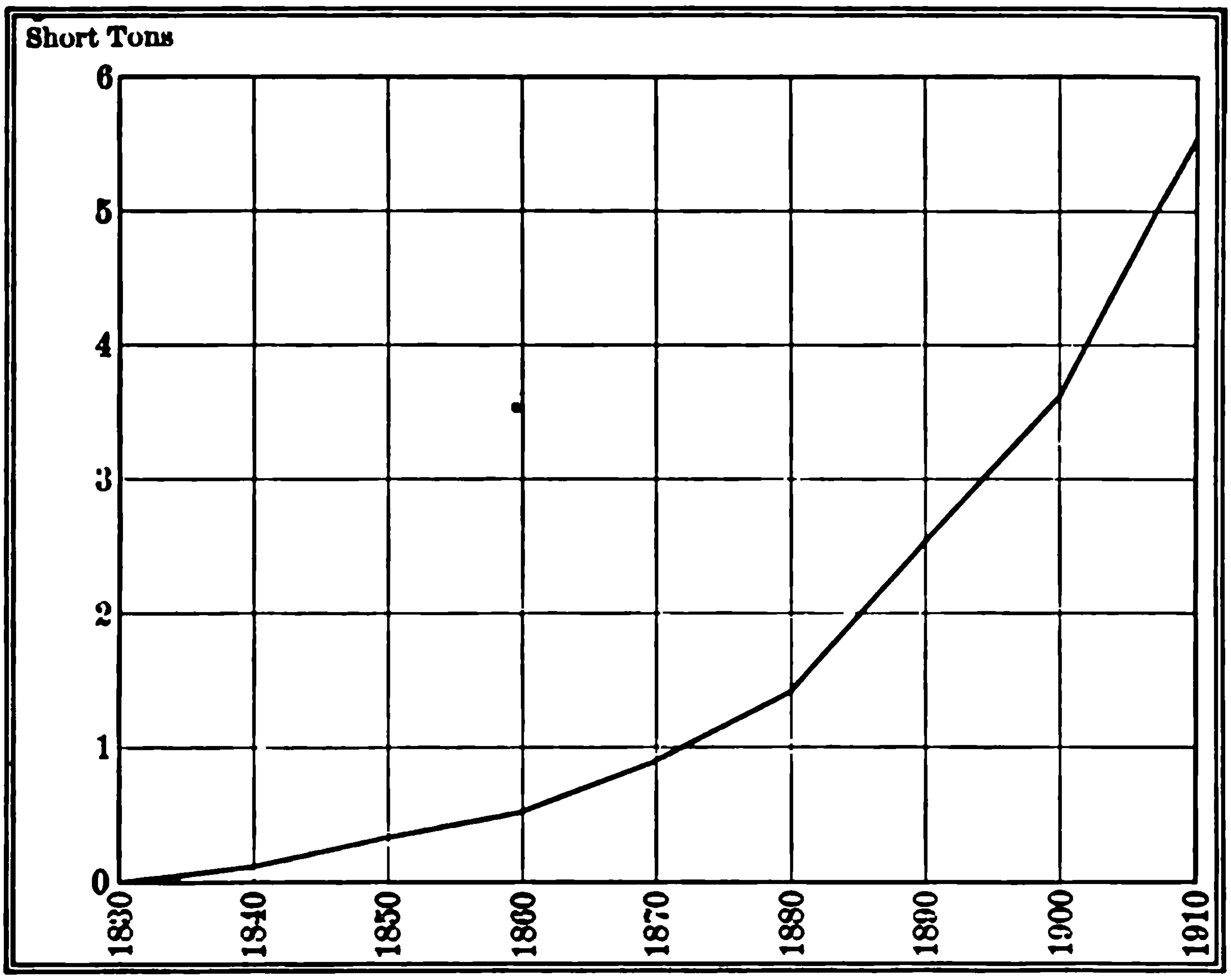


FIG. 2.—Per capita production of coal in United States, 1830-1910.

The Influence of Coal and Iron.—When man could resist cold and keep himself fed, civilization could go north. This depended upon the improvement of agriculture and the building and heating of houses. For ages this fight with the cold environment was slow. In recent times it has been most swift. The railroad with its accompanying car of coal has emancipated man from the dependence upon the local fuel supply furnished by forests, or

as in China; and has permitted a great rush of
ıanity into cold interior regions such as the Mis-
y and the plains of Canada, Russia, and Siberia.

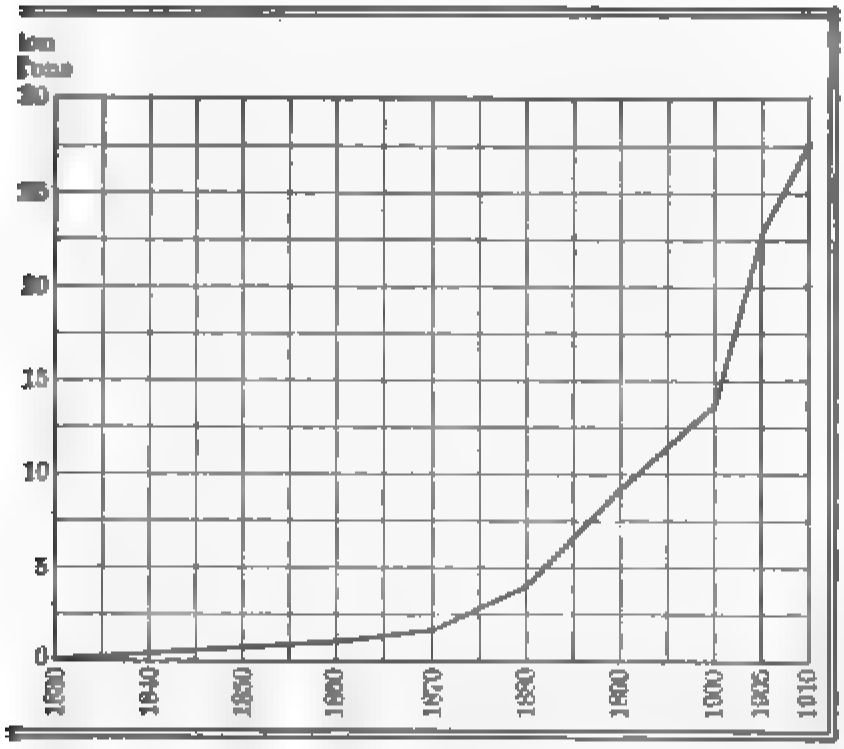
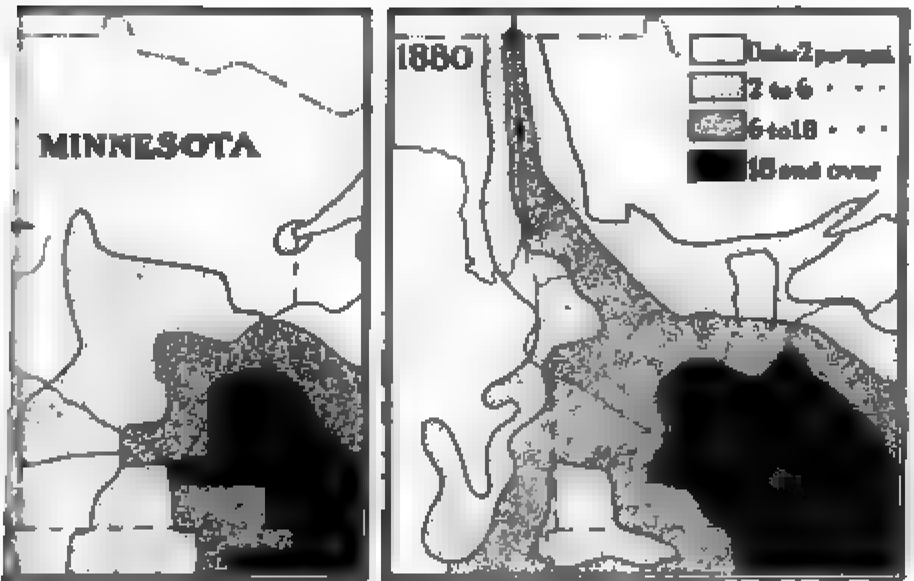


FIG. 3.—U. S. production of pig iron, 1830–1910.



Map showing distribution of population in region of Red River
1870. (b) Population map of region of Red River of the North
n W. S. Tower.) (The open plain is easy to settle after the coming

an race is thus being much more exposed to frost
ly, probably to its benefit. Cold is a great stimulus
Men and animals alike want to move more rapidly

on a brisk, cold day of winter than on a sultry summer afternoon. This is as true of nations as of persons. The most energetic and powerful nations therefore are those living in a climate where frost forces them to activity and where the warm summer enables them to produce vast supplies of food.

The great cities of the world's so-called Great Powers are surprisingly close to the middle latitude between the extremes of heat and cold. The cities that make the policy of world politics are New York, Boston, Philadelphia, Washington, Chicago, London, Liverpool, Edinburgh, Paris, Berlin, Hamburg, Leipzig, Vienna, Rome, Milan, St. Petersburg, Moscow, Pekin, and Tokyo. Every one of them has snow in winter and a hot summer. They all lie in the middle third of latitude, none being above 60° or below 30° N. North of this line of centers of world leadership, the population and power decline because there is too much frost to allow production, and south of it power and national energy decline because there is too much heat to permit activity, although the tropics teem with unmatched possibilities.

The Influence of Natural Protection and Beasts of Burden.—The origin of civilization cannot be explained solely on this basis. These factors are present but others also enter. Shaler, with his keen appreciation of man's relation to his environment, has pointed out the influence of easy defence. The community that has become agricultural is, with its stores of food, the natural prey to hungry nomads. One of the essences of war is transportation—speed, mobility. This is the daily practice of the nomad. From the times of the shepherd kings of Egypt to the raiding Apaches of Arizona, and doubtless back to the very dawn of progress, one of the commonest cycles of human history has been the conquest of the shore or valley farmer by the nomad—Mede, Goth, Vandal, Hun, Angle, Northman, Arab, Tartar, Turk.

The American Indian suffered greatly from this cause as well as from the poverty that lack of beasts of burden imposed upon him. In the open country of eastern America any locality was open to easy attack; not so the cliff dwellings of New Mexico and Arizona where in an arid region the greatest Indian progress was made by people who lived in fastnesses easy of defence and laboriously tilled fertile patches of irrigated land in the valleys below.

ir reasons civilizations arose in such nooks as Athens, te, and Etruria, while the great open plains of Russia America have remained half barbarous until the century brought governments strong enough to keep give the same protection that was afforded by a shel- r in Greece.[1]

3. THE NECESSITY FOR COMMERCE

e Evens Up the Inequalities of Lands.—The limita- pport for a people living by one resource serve to the necessity for commerce. The early South Sea aw of shark's teeth set in wood was much more expen- or than that which his descendants get by trading the schooner's side for the product of Sheffield. Few e capable of supplying, even in a poor fashion, all the s desired by civilized man. Hence the imperative commerce to get the products of other lands. Com- been essential to the spread of civilization, and civili- very naturally lingered in those localities that afforded and opportunity for commerce. Without commerce, of selling as well as buying, a locality with a great

an Arab to do when his camels, his sheep, his wife, his children, re all suffering the pangs of hunger? The only resource under tances is plunder. The man who is starving has little thought rong. To have such thoughts would seem to him fatal. If s of humanity or any other moral idea prevent him from ids upon the tribes around him the doom of his family is sealed, en die of hunger. Thus through the thousands of years since ds first lived in Arabia, the hard conditions of climate have ed out all who withheld their hands from violence.

who would succeed and who would keep his children in not only be ready to commit depredations and be utterly ording to our standards, but he must also be strong in the heat, thirst, and the weariness of long rides; unfortunately, has little need of steady industry or of strength to endure long r. In a word laziness, according to our definition of the reat disadvantage provided a man is able to summon up his risis when the camels have strayed far away, when they have ff by raiders, or when the man himself goes on a foray. Hence zy as well as utterly disregardful of the commonest principles Just as he thinks of raids as a part of the ordinary routine of nks of steady work as something scarcely to be demanded even d fit only for slaves."—From *The Arabian Desert and Human* r Ellsworth Huntington, *Journal of Geog.*, Jan., 1912. The Arabs in Spain under another environment is an interesting

surplus of natural wealth could make no use of it and therefore could have no large production, for large production requires wide markets. Production itself, the industries of any region, and the way it supports its population, can only be understood by noting the influence of commerce in stimulating the industries and making possible the support of large or small numbers of people.

Commerce is first of all dependent upon transportation. Men can trade without money and by signs without even understanding each other's speech. The important thing in all commerce is the fact that the goods can be moved. Accordingly, commerce is great only where transportation is good. Since the boat moves more cheaply than the pack animal, the wagon, or the railroad train, we find that waterways, the sea, the river, and the canals are the routes of greatest commerce. The greatest cities are seaports, and so great is our dependence upon water transportation that one might name a hundred of the world's largest cities before coming to one where boats did not discharge their cargoes.

Transportation that Depends upon Animal or Man Power.—Without the boat or the railroad, commerce is a minor thing. The horse-drawn wagon enters into commerce that is modern only by taking goods to and from the railway or boat. Where commerce depends entirely upon animal muscle, as the horse-drawn wagon or the caravan, we have the commercial conditions which made the Middle Ages. These means still serve a surprisingly large portion of the earth's surface, but a very small proportion of its population. The first great commercial enterprises of which we know were carried on by means of caravans. Such caravans as set out from Egypt in the days of Pharoah, and from Babylon in the days of Nebuchadnezzar are to-day the chief commercial dependence of a vast region reaching from the shores of the Atlantic in northwest Africa eastward to Pekin. Here and there in this vast stretch are two or three lines of railroad, but the main dependence is still the caravan, chiefly of camels, sometimes of horses, mules or donkeys, and occasionally of wagons. By such means and over such great distances, only the most valuable goods can be carried, and accordingly only the most costly goods are worth caravan freights. Nearly everything that man uses here must be

ıis immediate locality. The high cost of trans-st drives man back upon his own resources in vast a, northern British America, north Europe, and where commerce depends upon the sledge drawn .e New World and sometimes by the reindeer

ıouse of the new settler on the treeless prairie of North ›den house is so warm, and commerce has made the minimum .

Transportation to Civilized Communities.—Large erate Siberia are still remote from railways; good ent and nearly all their commercial products are he winter-time when the snow makes sledging so :han summer hauling by wagons over bad roads. solation makes conditions that no large community Consequently the large modern community can here commerce is also modern. This condition ists where the boat and the railway transport our ·egularity. The new means of conducting com-greatly widened the area over which civilization Before the coming of steam only the localities many resources or easy access to the sea could

furnish the many commodities necessary to support a civilized community. But now the railway and the steamboat make it possible for a backwoods district having but one product in abundance to supply its inhabitants with all the varieties of goods in the metropolis, because it can sell its one product and buy in return a thousand different things that the people need. When crops are good, the farmers of Saskatchewan, who sell only wheat, buy American books, magazines, French gloves, English traveling bags, Chinese tea, New England clocks, Michigan automobiles, and goods from a thousand distant factories.

The great and nearly empty plains of western Canada give us a chance to see how civilized communities take possession of the earth and how dependent they are upon their present freight carriers, the coal-driven locomotives. Land is being given away by the Government to new settlers. Every new railroad means new settlers along its lines. The new settler often finds, however, that the land near the railroad has been bought up by speculators, and is being held at a price which he may not be able to pay. Farther back from the railroad there is free land, but the wheat grower cannot afford to haul wheat in wagons more than 40 or 45 miles, even though he can then get good land for nothing. As a result the land 50 miles from the railroad is a wilderness, or a pasturage, though it may be a smooth, level, fertile, prairie ready for the plow, rich in the possibilities of wheat and ready for any farmer to come and take possession. He can take possession only when a railroad, the most controlling of all factors of commerce by land, comes near enough to make possible the marketing of his products and the supplying of his wants. Such has been the history of the settlement of all that vast farm-land plain lying beyond the Mississippi River and reaching from the Gulf of Mexico northward beyond Winnipeg to a place where, thus far, the bitter elements of the north have stopped the advance of the farmer. The heart of Russia and Siberia where the largest of Empires reaches eastward is just now being pierced by new lines of railway, making possible the immigration of the Russian peasants into untilled Asia, as the Americans and Canadians are going westward into empty Canada.

ı be some sparse settlements more than 50 miles way but they are few and small, with export products ticles of high value such as wool or precious metals, s and herds which can walk to the railroad. This .e case in Australia, Argentine Republic, and the . of the United States; but the coming of the railroad riably produces in an arable district a several-fold opulation.

.e frame house, barn, outbuildings, silos, water tank, and fences American dairy farm require much wood, often brought long '. S. Dept. Agr.)

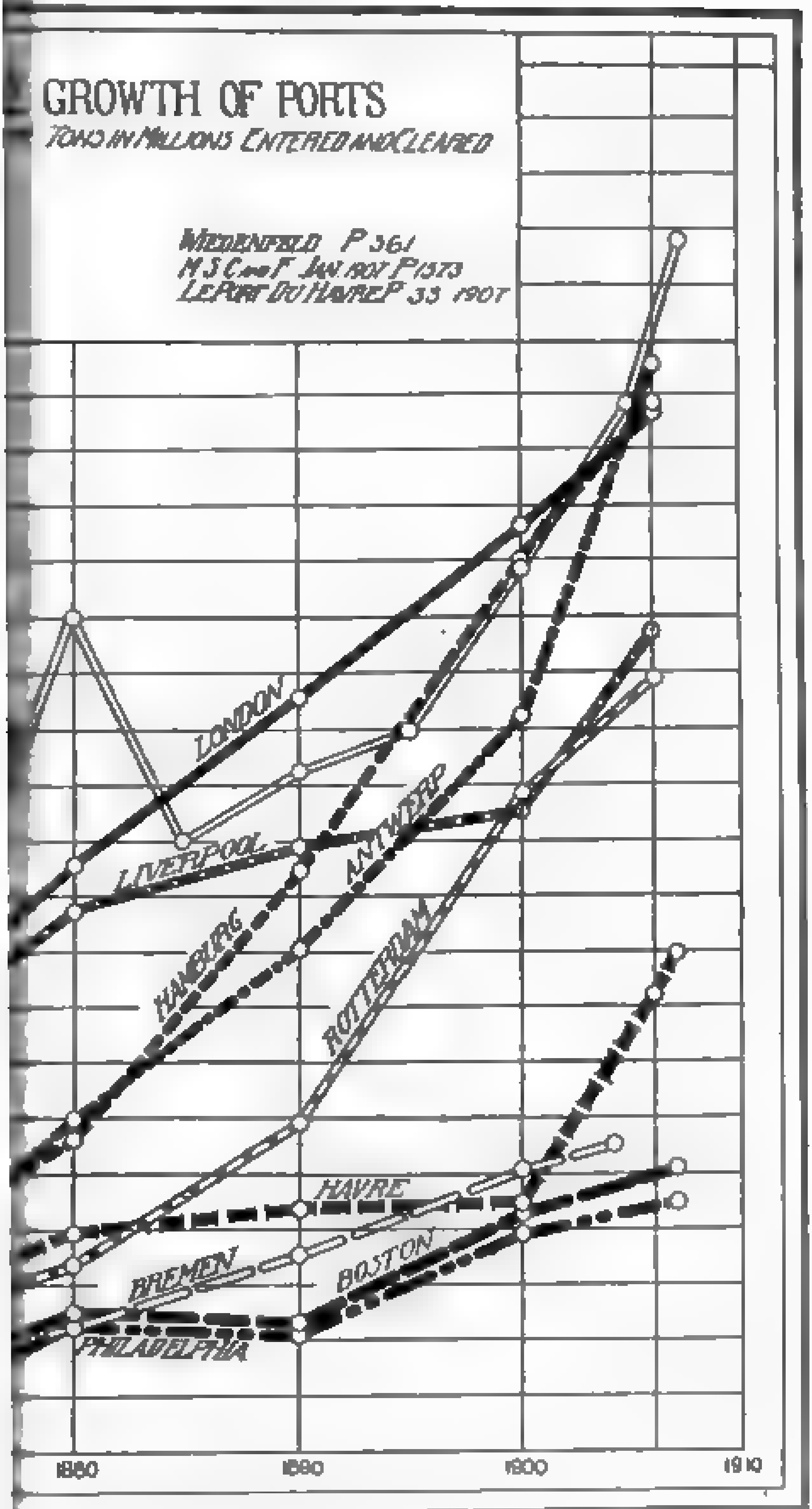
vay, the profound changer of man's environment, ial that it is now spreading into new territories more n ever. The environment of mankind is undergoing t and most sudden revolution that it has ever experi- is the change from the local environment in which onditions dominated, to the world environment to export commodity admits us and which tends to ll alike. As evidences of response to this unifying ronment, we see the white man in all lands, the Indian, the Maori, and the Japanese putting on the Europe, and the Chinese cutting off his queue and r sons to the Universities of the western world. rld environment creates a world commerce and a ket which we must understand before we fully com- an's relation to any community.

4. WORLD COMMERCE AND THE WORLD MARKET

The New Commercial World.—We sometimes speak of the Old World—Europe, Asia, and Africa—and of the New World which Columbus discovered more than 400 years ago. In this sense the word "new" is used with regard to mere geographic discovery, a date. If we look at things from the standpoint of the way man is being supported, it is plain that we have a newer world, the world of modern commerce which depends upon the steamboat and the railway. As real servants of mankind the steamboat is less than a century old and the railway less than seventy-five years old, yet they now support practically all the large cities of the world and have created the most of them. During this short period, we have come to depend on transportation that makes great commerce, and man's relation to his immediate environment is entirely changed. One of the greatest of geographers, Penck, has pointed out that under any condition it takes a certain space on the earth's surface to support a man, but that, since we have acquired the new means of transportation, a man's home space or the place where he lives may be far removed from his sustenance space or the place which produces the necessaries upon which he lives. This possible separation of the sustenance space from the home space has come almost entirely within the past hundred years, chiefly through the assistance of coal and iron working together in the form of the steam engine.

This separation of the home space and the sustenance space has made possible the great and rapid expansion of large cities, as New York, London, and Chicago. In all three of these cities people may and do eat bread that is made from wheat grown in Minnesota, meat from cattle raised in Texas, wear clothes from wool produced in Australia, and in a hundred ways depend upon the coal and iron and products brought from remote parts of the earth.

The World Market.—We have as a result what may be called a world market. Such a market exists for any commodity that is either produced or consumed over a large part of the world, and is sufficiently portable and durable to permit people in widely separated regions to be interested in the buying or the selling of the same consignments. In the days of the sailing vessel, the



[...] growth of world commerce. (After J. Paule Goode.)

world market was unimportant, because, with the unsatisfactory, slow, and costly means of communication, only a few valuable and unperishable commodities could be transported long distances. The staple commodities of the world trade and the world

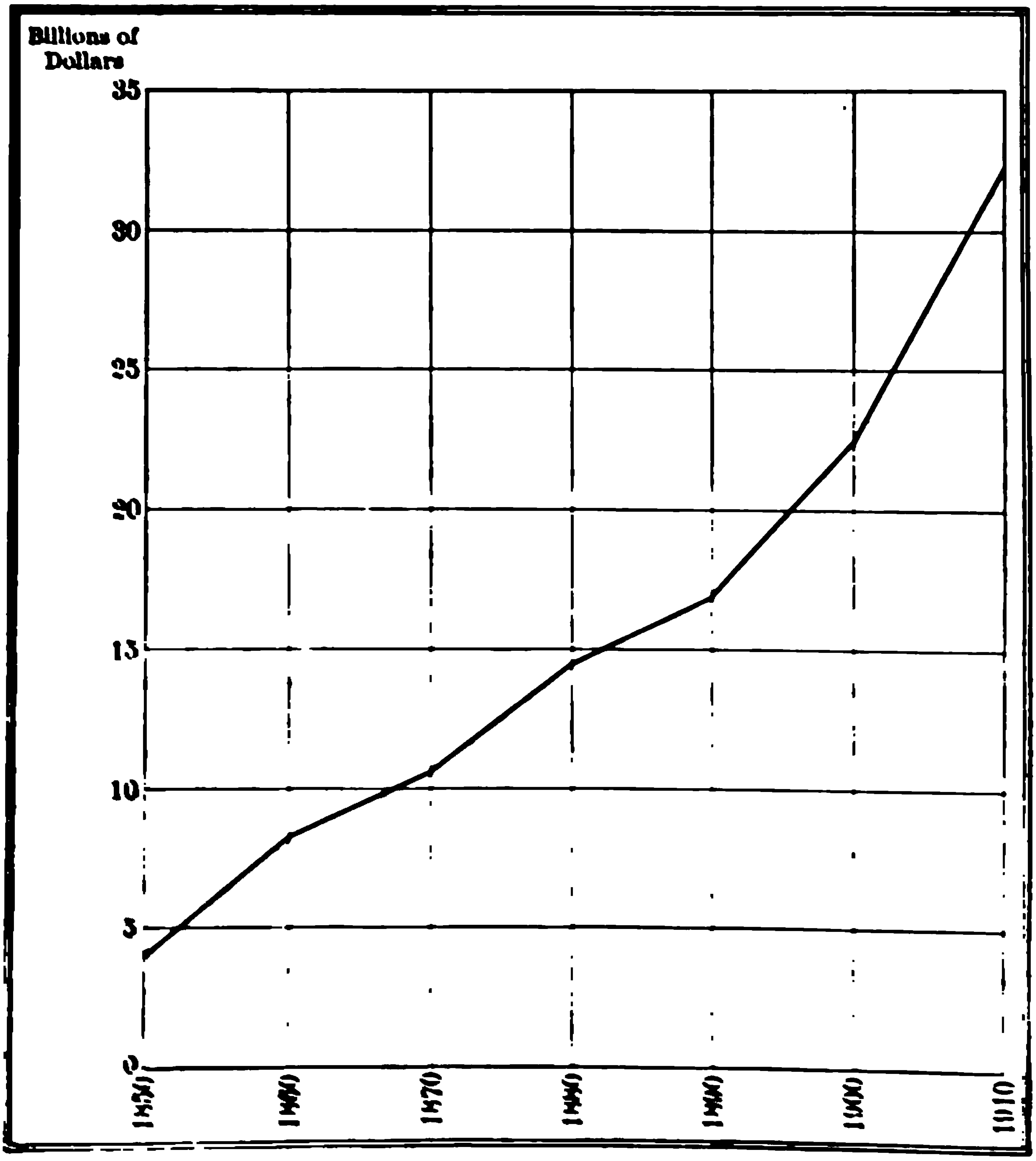
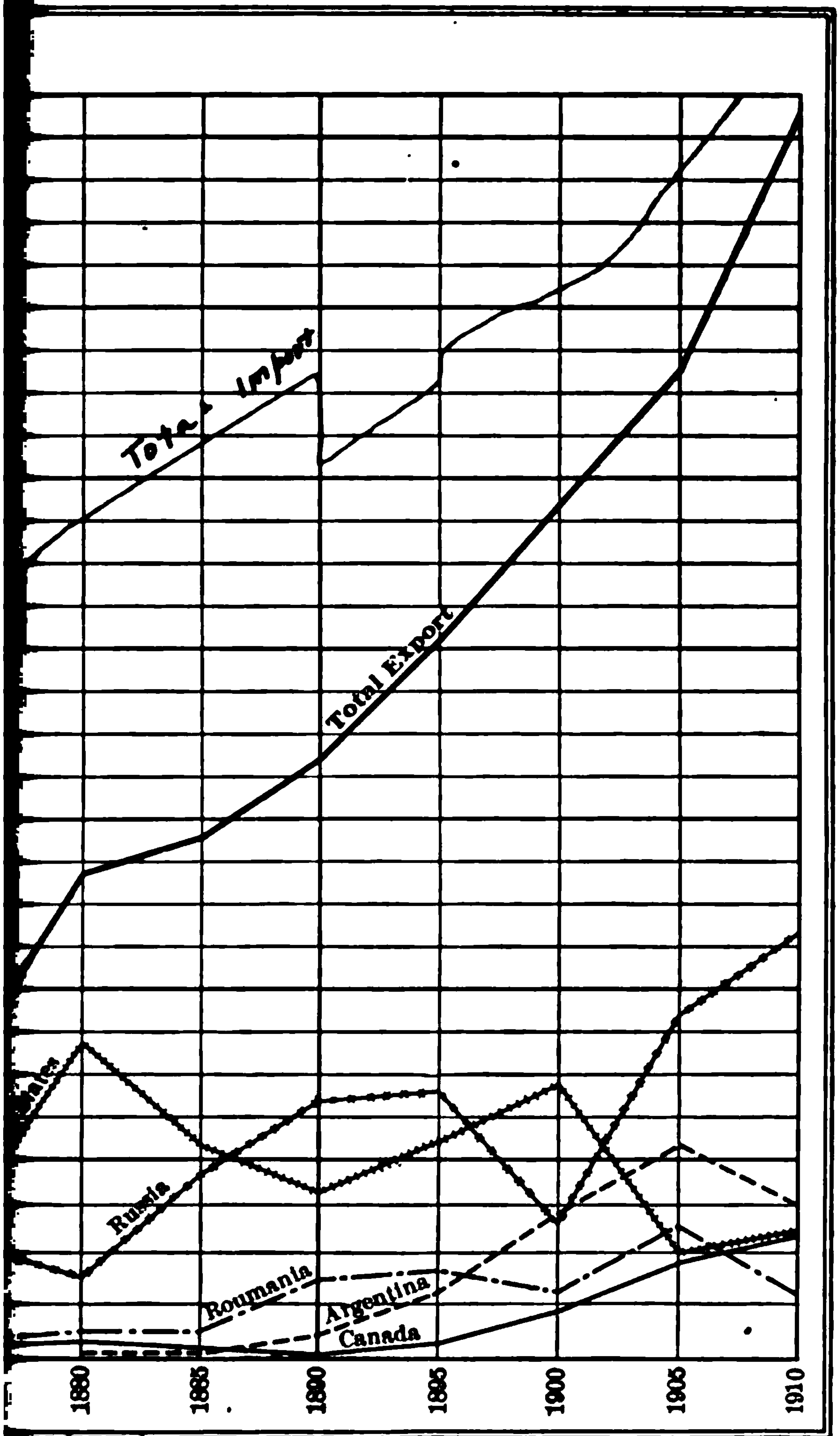


FIG. 8.—The growth of world commerce, 1850-1910. Combined imports and exports of foreign commerce of leading countries.

market of that day were spices, silks, tea, coffee, furs, and curios made by the peoples of the different races.

The staples of a century ago are no longer the great staples of the world market. They are handled in greater quantities than

ıd bulky goods have become the staples since
ve their railroads and all oceans their steam-



ld export of wheat and flour in millions of bushels.

r which India was once so important, are now
of exports.

, tea, coffee, and spices were the chief articles
rld market. To-day the important food staples

are wheat, corn, oats, rice, sugar, beef, pork, mutton, butter, potatoes, apples, oranges, and bananas. These are the great staple foods of the white race, and, in part, of the other races also.

The fact that staple foods can be produced in the heart of one continent one year and sold in the heart of another continent the next year at a cheap price, means to most of us a comfort and security usually unrecognized, because we have nothing with which to contrast it. We know nothing of famine in America or western Europe, but two centuries ago it was a nightmare that haunted all peoples. If a season happened to be too dry or too wet, or some sudden blight or disease broke out and made a local crop a failure, the people of the locality had to go hungry because there was no means of carrying bulky foods any great distance. In England the months of April and May were called the starving time, because the new spring crops were not sufficiently ripe to be eaten and the supply from the crops of the year before often ran low. Now the Englishman's breadstuffs come from Chicago, Minneapolis, Odessa, Buenos Ayres, or Bombay, and his meat from even greater distances. The starving time has dropped from his calendar because there is a world market for wheat, rice and meat, sugar, coffee, and even potatoes, and the Englishman has something with which to buy them. The world market staples of clothing a hundred years ago were silk and furs—luxuries for the rich. To-day they are cotton, wool, hides, skins, cotton-cloth, shoes, and hats—the clothes of the masses. In almost every school-room in the United States is clothing of wool, cotton or leather from two or three continents.

A century ago world commerce brought for the equipment of man in his activities little but lumber, trinkets, and curios. To-day there is a world market for iron, steel, cement, coal, ores, locomotives, machinery, jute, Manila hemp, and other fibers, so that the school building and the dwelling house usually have in them materials that have been carried thousands of miles.

China and the World Market.—China is the last great country to begin to patronize the world market. There the domestic system still continues to a great extent, and railroad building has just begun. Most interior localities there are still self-supporting. Each farmer saves his own garden seeds and raises his own food, his wife spins and weaves cloth and makes the family clothes;

mmerce, and the world market are rapidly
ic condition of China like those of Europe
tes—a part of the world of standardized
icated industry and necessarily increased gov-

e growth of cities and of great commerce is
n is not founded on fact. England leads the
of city population and the ports of Europe
e of America.

CHAPTER II

THE PLACE AND NATURE OF AGRICULTURE

Agriculture comes first in any general study of the industries that arise from man's attempt to win support from his environment. Historically, it is by agriculture that man has come up from the stage of the wandering nomad who followed the hunting savage. Industrially, agriculture precedes manufactures in all nations. It is the first and fundamental group of industries. No nation has risen into importance in manufacture and commerce until after it had developed and lived by agriculture. Agriculture furnishes raw material for the factory and food for the worker, and the number of people engaged in farming tends to increase as countries grow in manufactures and commerce, although the proportion engaged in agriculture may decline, as it has in Great Britain and Belgium, because of heavy importation of agricultural products. Another important aspect of agriculture is its permanency. The mine must be exhausted, the forest usually is, and the importing of raw materials from abroad is at best uncertain and at times temporary. Thus England will probably be unable to secure breadstuffs and meats from the United States much longer because of our own increasing consumption and declining export. In the long run the only sure dependence of a nation is its soil resource, upon which depends agriculture, the fundamental group of industries, and the soundest basis of national strength. Granted good agriculture, a nation may develop and maintain manufactures and commerce; without it, a nation is at best in unstable equilibrium and dependent upon other nations.

In the study of commercial geography one must look closely at the factors that make for the support of human life—the fitness of land to man. Fortunately this fitness of lands to support us is rapidly increasing in spite of the present destruction—often reckless and useless destruction—of resources. Our inventions, discoveries and new abilities to do new things in both manufac-

ulture enable us to create new products and get
'e easily, so that the various kinds of lands that
orld will support more people than at any previous
same time that old lands have the possibility of
tivity, new lands are coming rapidly into use.

Transportation and the World Market to Agricul-
ie rise of the world market and world commerce,
; product will support more people in greater
r than could have been done in a locality with
s many products in the older periods. Before the
roads, level treeless plains in the continental in-
nost useless to man and he clung to the waterway
r fertile and productive the treeless plains were.
of shelter and fuel were perplexing without trees or
he only way this difficulty could be met was to
hods practised by the people of northern China,
eeded in living in the old fashioned way on such
ling mud or unburned brick houses covered with
ing, for fuel, the coarse stalks of a kind of millet
w as an annual crop for this purpose. Owing to
this fuel supply they must economize severely, and
e no attempt to heat their rooms. They wear
n clothing instead, and sit by day and sleep by
ow, hollow brick platform continually kept warm
of millet stalks smouldering beneath it.
nerce enables western peoples to live very differ-
plains. The vast treeless plains from Texas to
l westward to the Rocky Mountains have become
illions of comfortable farmers and townsmen, who
od and their coal hundreds of miles and pay for it
eat and corn and cattle, their hogs, their horses,
while they sometimes ride in automobiles and live
plied with bath-rooms and gas lights.
that a community can arise wherever one salable
e produced, has multiplied the world, and makes it
xamine a region very closely to see its possibilities.
the fundamental character and enduring nature of
ne of the first things to note in the examination of
its fitness for this group of industries.

Agriculture More Difficult to Understand than Manufacture.—Agriculture is affected by the forces of nature more than is manufacture. It consists primarily in the growing of plants, which are more affected by the weather, especially temperature and moisture, than they are by the soil in which their roots are fixed,

Fig. 10.—World rainfall, annual. (After Mark S. W. Jefferson.)

Very heavy—an annual rainfall, including melted snow, of over 80 inches.
Heavy—an annual fall of from 40 to 80 inches.
Light—an annual fall of from 20 to 40 inches
Scant—Less than 20 inches in the year.

although the soil, too, has great influences. The weather is notoriously changeable and uncertain, and each crop and animal has its own nice adjustment to the environment. This dependence of agriculture upon the uncertainties of nature is in strong

ɜanufacturing, which goes on in factories almost
ɗ the weather, and dependent upon a comparatively
of factors, all within the control of man.
is really a group of industries. It is a mistake to
ing with any single branch of manufacture, merely
are so many kinds of manufacture. There are also

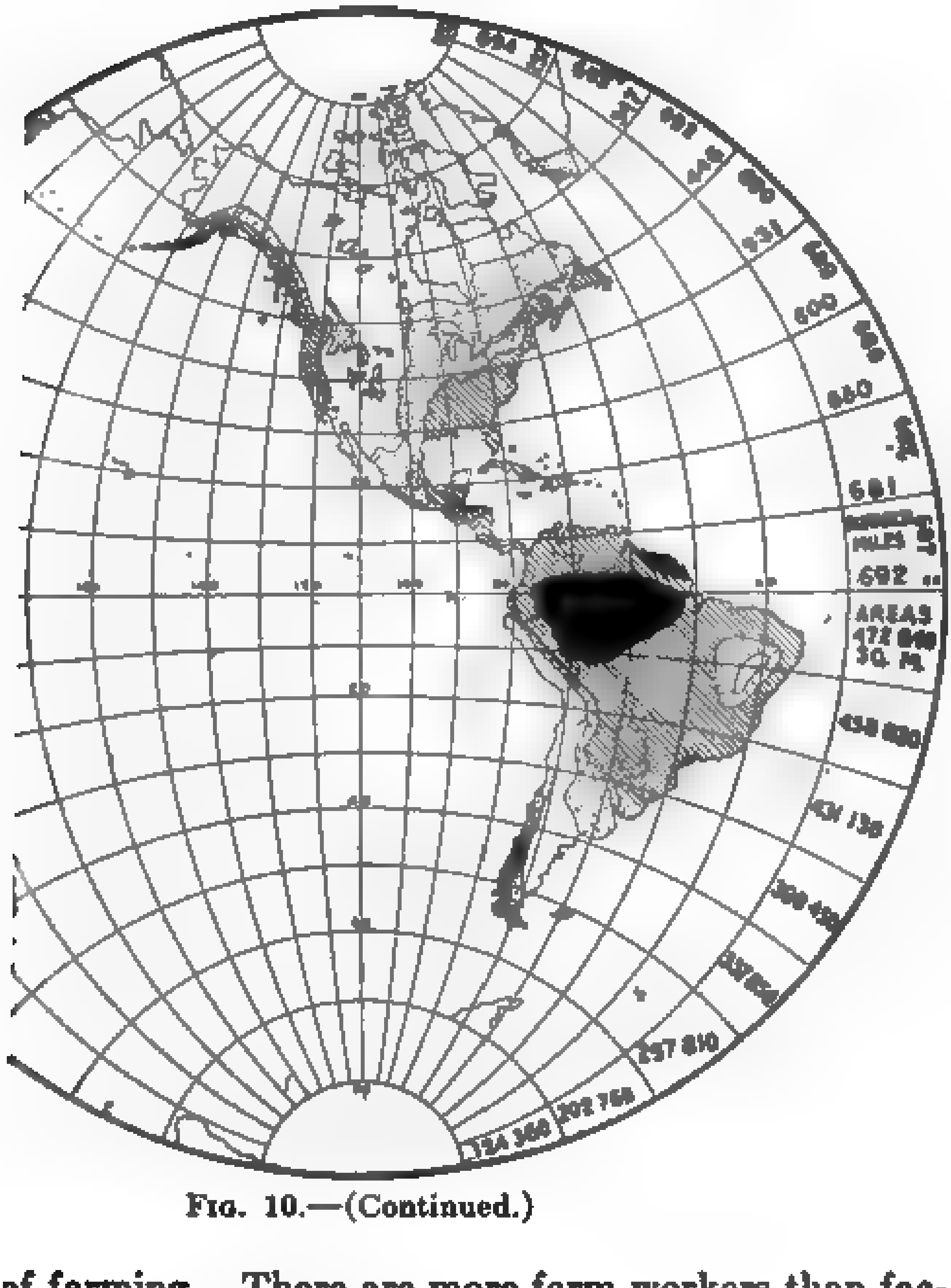


Fig. 10.—(Continued.)

of farming. There are more farm workers than fac-
, in the United States; and throughout the world at
ı greater proportion of the human race is employed
n in factories. Through the materials and food it
.e farm supports alike the factory and the factory
l enables them to render their great service to

Farming in the Domestic Epoch.—Farming, like manufacture, has been revolutionized by world commerce. In 1786 a Massachusetts farmer wrote a book telling just how he supported his family.[1] With the wheat and corn and buckwheat that grew in his fields he furnished the family bread. The chickens,

Fig. 11.—World rainfall, June, July, and August. (After Mark S. W. Jefferson.)

Heavy—more than 10 inches of rain and melted snow in the three months.
Light—from 6 to 10 inches in the three months.
Scant—less than 6 inches in the three months.

pigs, sheep, and an occasional beef animal that he slaughtered furnished the meat. His garden furnished all the vegetables and his orchard all the fruits, many of which were dried for winter use. The farm produced the family food. For clothing,

[1] See MacMaster, J. B., *History of the People of the United States*, Vol. I.

the wool which he sheared from the sheep; and grew in the corner of a field was made into linen. ıe meat animals was tanned and made the family's ıs were they clothed. The trees from his wood lot boards to build his house and the logs for his fire for such fences as were not of stone. He himself,

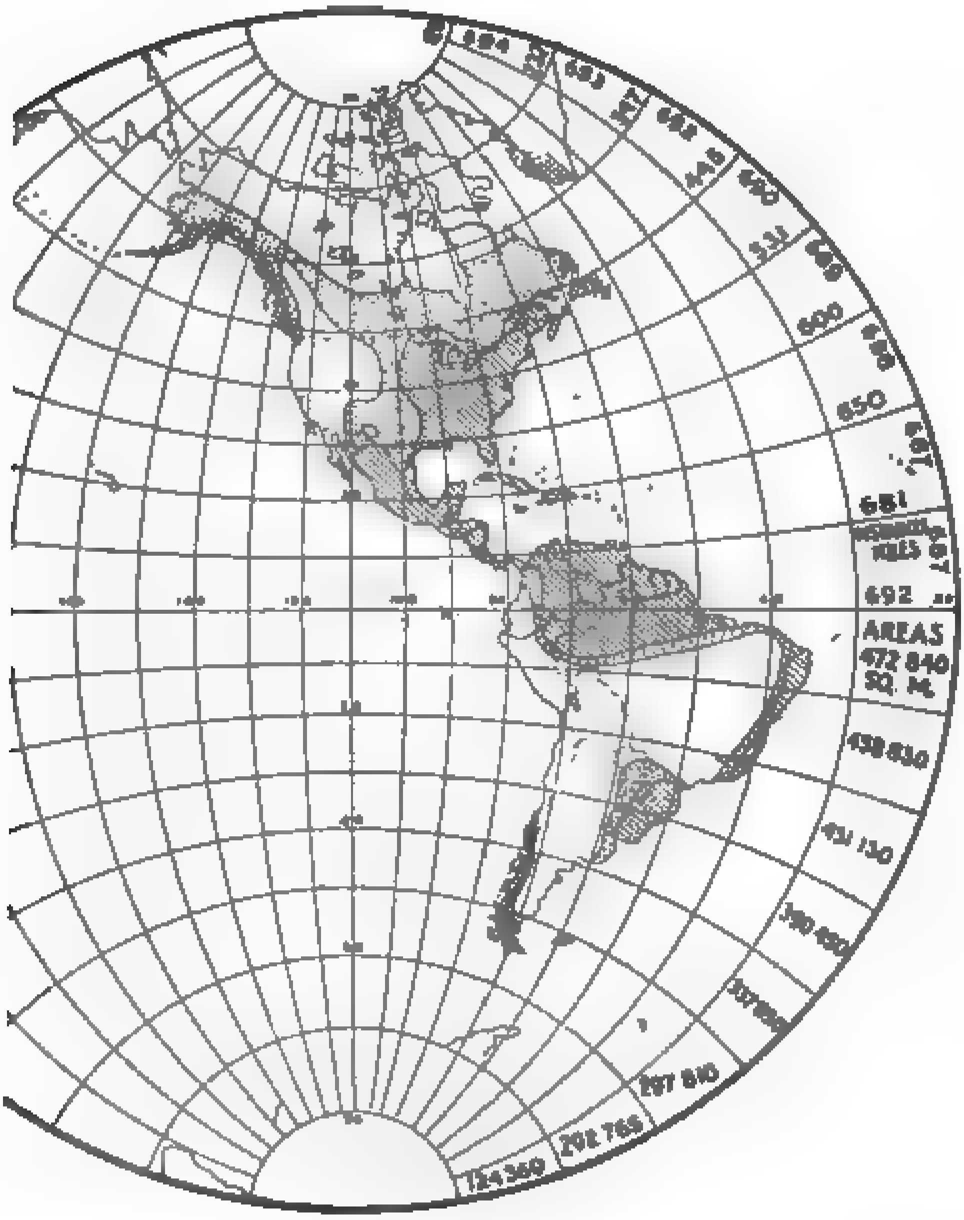


FIG. 11.—(Continued.)

ers of that time, was a fairly good worker in wood, little blacksmith's shop so that he made practically ı tools on rainy days and in snowy winter weather. hings were needed from the outside world, such as and iron for his little forge. These outside products a year, permitting him to save $150 out of the $160 the wheat and cattle that he sold. This complete-

ness of support was obtained by an amount of hard work and discomfort that would not be tolerated in this age of commerce and division of labor.

Farming in the Commercial Epoch.—Since the coming of the epoch of coal, steam, and machinery, the farmer, especially the

FIG. 12.—World rainfall in December, January and February. (After Mark S. W. Jefferson.)

Heavy—more than 10 inches of rain and melted snow in the three months.
Light—from 6 to 10 inches in the three months.
Scant—less than 6 inches in the three months.

American farmer, sells more and buys more, and his family usually does less work. His shoes and clothes are factory-made, the lumber for his new barn often comes from afar, as does the coal for his stove and the stove itself, as well as the tools, the wagon, and often the horse that draws the wagon. A much

product is required to support a family by the han the domestic system. The increased product or things not done on the farm. In the matter of lock of fifteen sheep yielding 75 pounds of fleece lantly clothe a family with homespun. If the nds of unwashed wool were sold at thirty cents a

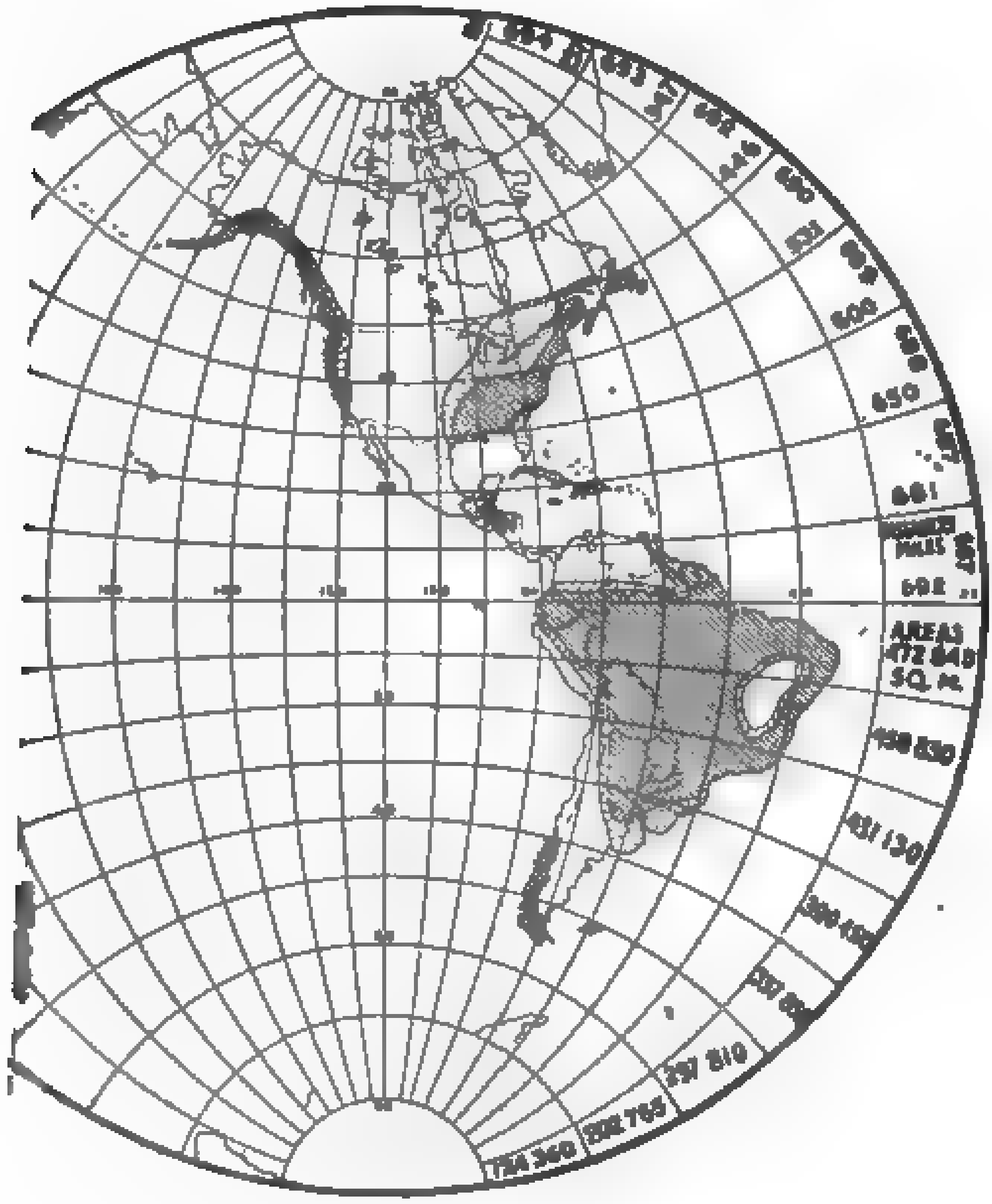


FIG. 12.—(Continued.)

resulting $22.50 would scarcely buy one-fifth as -made woolen clothing.

rops and Supply Crops.—In the commercial system, nportant consideration in connection with farming y crop. Every farm or every farming community more crops which are usually sold and converted

into cash, and hence usually called money crops. Among the world's great money crops are grain, sugar, animals, fruits and vegetables, cotton, wool, coffee, tea, and tobacco. The money crops do not occupy half the land in American farms, for most of

Fig. 13.—World distribution of population. (After Mark S. W. Jefferson.)

Grade of peopling.		People to 1 square mile.
Very dense.		. . . 250 or more
Dense		. . . . 125 to 250
Moderate . .		. . . . . 26 to 125
Thin		. . . 2½ to 26
Scanty		. . less than 2½

the land is devoted to what may be called supply crops, that is, crops which are used entirely upon the farm and are sold, if at all, in some indirect form. For example, nearly half of the American farm lands are in grass. Some of it the animals eat in summer,

› into hay for winter forage, so that, while impor-
re and hay are not sold directly, but supply the
ducing something else. On many farms there
of corn, oats, hay, grass, and rye, yet these are

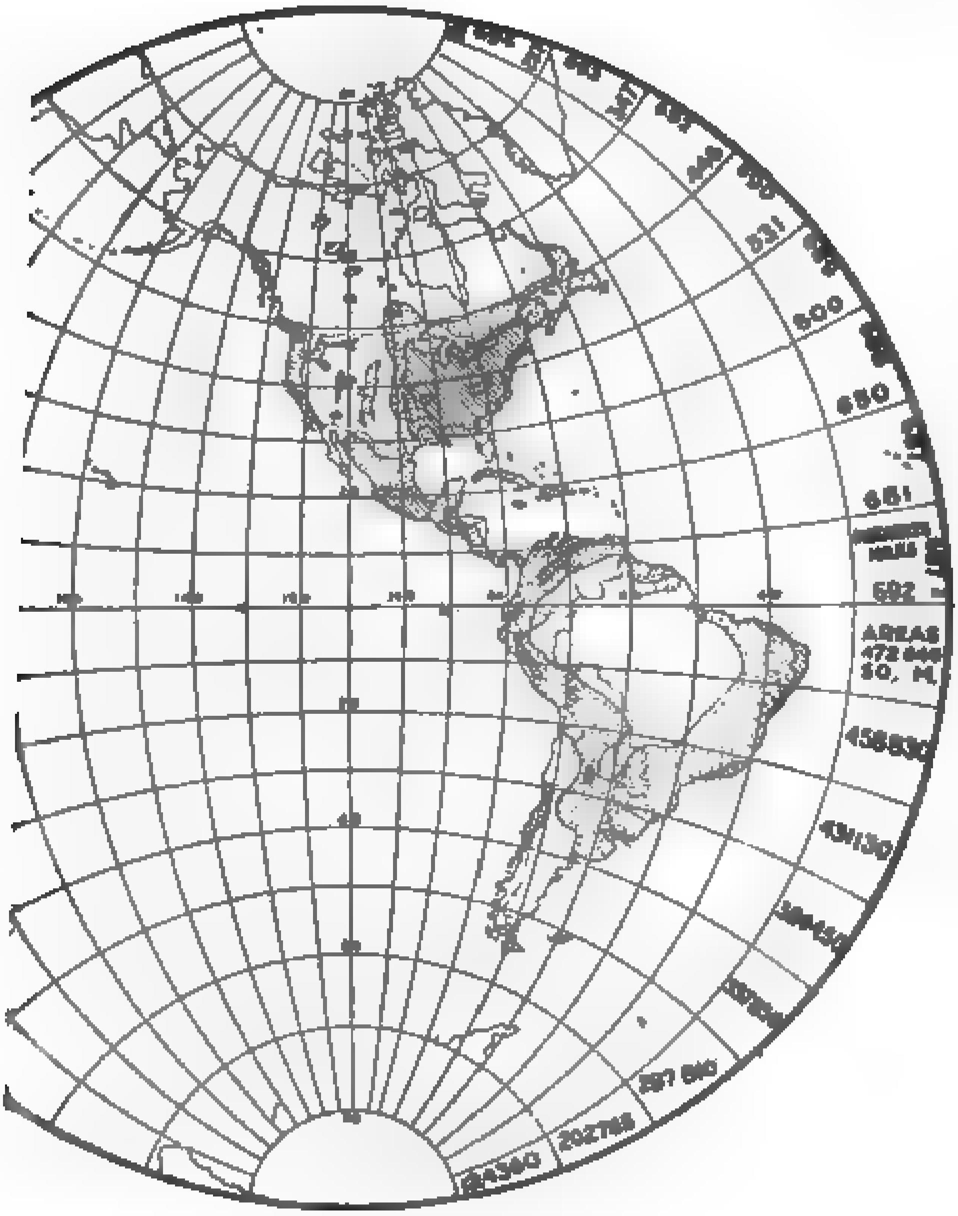


FIG. 13.—(Continued.)

ops contributing to the one money crop of milk,
, cattle, swine, or horses.

Dollar and the City Dollar.—The complete self-
the well-nigh money-free life of which the Massa-
er wrote 125 years ago, is gone; but a strong trace
in the fact that a dollar for the farmer is often as
wo dollars to the city man because he buys many
ly where they are grown, and he also produces

many things for home use. Nearly every farm has a garden, from which a complete supply of vegetables is drawn to last the family through winter and spring as well as for summer use. It also has an orchard in which peaches, apples, pears, plums, and grapes may be grown, so that no fruit need be bought, for the home supply can be stored, canned, preserved, or dried for winter use. One or two cows furnish milk and butter. A few chickens about the farmyard supply the farm with eggs and poultry, and usually leave some to sell for cash. More than half the farmers of America raise enough wheat or corn to make their own bread and have some left to sell. Millions of farmers raise a few hogs or sheep or cattle which they slaughter for their own meat supply. On almost every farm there are, of necessity, horses which the owner can drive, whereas the city dweller usually pays carfares, because the keeping of a horse costs him from $100 to $250 per year.

In contrast to all these products of the farm, which are had without direct cash cost, the entire food supplies of the city consumer must be bought, and at prices that are often several times higher than they were in the country, because of the great amount of work and expense necessary to get the products from the place where they are grown to the consumer's house. When the city housekeeper, for example, buys a basket of beans she pays for the beans and in addition pays for the following: one basket, the cost of packing the basket ready for shipping, cost of hauling it to the station, transportation charges from the farmer's station to the city, cartage from the railroad station to the commission house, commission to the merchant for selling it, cartage from the commission house to the grocery store, and profit to the groceryman. This profit must be large enough to include rent, clerk hire, delivery-wagon costs, and the value of the damaged goods that cannot be sold. According to a recent expert, all these costs and charges reach a total that amounts to sixty-five cents out of every dollar expended by the housekeeper in a great American city for farm products. Only the remaining thirty-five cents of the dollar is spent for the food itself, with the result that living in the city is much more expensive than living in the country—a frightful waste of effort and resource for an object that might be otherwise obtained.

all towns and country districts of the United can live with as great comfort and independence ır as one can live in a great city for $1,000; or, me rural regions referred to, $1,000 a year would ively wealthy, while $2,500 per year in a large relatively poor. These statements are made ;o the real country and not the suburbs, in which ıg is often higher than in the great cities, because more movement of supplies—from the city center ı town.

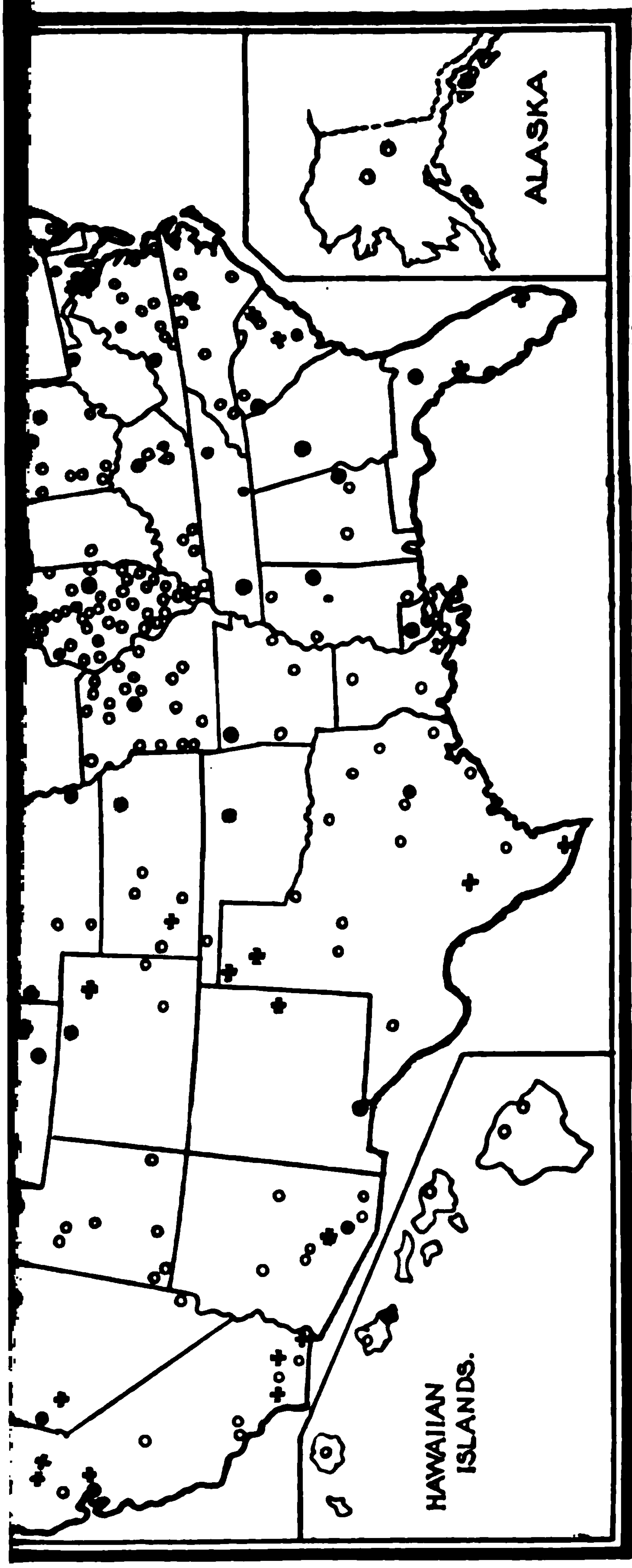
the United States has been through a period of ween 1880 and 1900, when prices were low and) get. Prices have recently risen. Cities have uddenly that these differences between city and tions have not been fully appreciated. Now, is coming a rapid increase of understanding of of living in the country, where one pays for the as contrasted with living in the great city, where ı addition, for a host of services that add no value ıd often detract from their value.

has also suffered from the disadvantage of isola- al dweller, which has partly caused the great rush ;et the social opportunity that comes of being near of one's fellows. The telephone, the trolley and ery of mail are greatly improving the social possi- rican country life.

ation of Science to Agriculture.—Farming is st scientific branches of production. The factory 'ations involving a science or two, but the farmer h soil chemistry, plant nutrition, animal nutrition, ses and enemies of both plants and animals. He is own purchaser, salesman, and mechanic. Much required in all this wide field, but in no occupation so difficult. Experiment consists in altering *one* thers remaining as before. This the vagaries of humidity, rainfall, sunshine, and accident so rarely xperiment in agriculture is difficult and superstition ongest in the most scientific of industries. When with experiments it often takes years, and then the

cycle of production is so slow that there may not be much of his life left in which to profit by the experiments. In a factory an experiment may easily affect more cycles of production in a year than farm experiments will in a lifetime. Further than this, many experiments of great value to agriculture are too difficult and costly for farmers to perform, but, at the same time, they may be of great profit to a community or state. Hence agricultural experiment has been largely taken up by the state. Nearly all progressive governments are working systematically to promote agricultural production. In the United States we have in every state a college of agriculture and the mechanic arts, with practically free tuition. Every state has one or more agricultural experiment stations where men are constantly making scientific discoveries and testing the usefulness of other discoveries for their particular localities. These results are published and distributed free, so that the individual farmer may be able to use the latest results of science. In addition, we have at Washington, under the national government, the Department of Agriculture, which is one of the greatest scientific institutions in the world. Along with many other lines of work, it sends its explorers into the Desert of Sahara, into subarctic Russia, into Turkestan, Mongolia, and the ends of the earth where perchance may be found some plant, or practice, of value to some part of the United States. This plant introduction work alone promises to increase the productivity of the United States more than would a new state.

Germany, with eighty-seven experiment stations in 1904, leads the world in the promotion of scientific agriculture. On her area, which is smaller than Texas, are twenty-six more experiment stations than are to be found in the whole United States (not counting substations). England, France, Holland, Belgium, and all progressive countries of Europe are also in the same work. Uruguay and Argentine are going at it in earnest. Cyprus (British) is well equipped, while Japan is, in some respects, more advanced than any other nation, but the United States is now making rapid strides. This world-wide distribution of scientific research for agriculture gives to Massachusetts or California the possibility of hearing at once of discoveries that may be made in Germany, Japan, or Sweden. The result is that it



● State Experiment Stations. ○ Sub-stations. ✚ Permanent Field Stations, U. S. Dept. of Agriculture (Bureau of Plant Industry.)

FIG. 14.—Map showing the location of agricultural experiment stations and substations in United States.

is now becoming possible for agriculture to be actually one of the most scientific of all industries, since the experiment station and the Department of Agriculture bring experimental science within the farmer's reach. As a result, agriculture is becoming an interesting occupation for the educated man. We occasionally hear of the new movement of people "back to the land" with its independence and occasional leisure. Such movement is greatly stimulated by the increased cost of living,

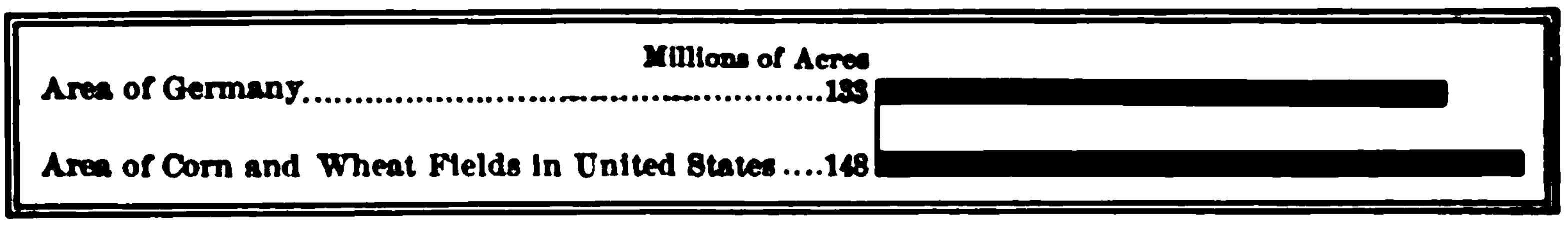


FIG. 15.—An explanation of the fact that while Germany remained agricultural, there was large emigration of her people to the United States.

which, since 1900, has made the double pressure of more costly living in the city and, at the same time, higher prices for farm produce. Along with the higher prices, improvements in transportation and marketing give new opportunities to reach a world market, hundreds or thousands of miles away.

The greatest work for the promotion of agriculture now is the popularizing of science;[1] not more discoveries, but the practice of what is now known, so that we may have an agriculture that is adjusted to resources. This adjustment is a very complex thing; for the crop selection is influenced by character of soil, land values, labor supplies, transport facilities, climatic conditions. and the likes, dislikes and abilities of men.

Crop Rotation and the Intensification of Agriculture.—The start of agriculture is almost always the plantation system—the

[1] As an example of results of such endeavor, note the following astonishing increases in average yield resulting from twenty-five years of teaching in Belgium.

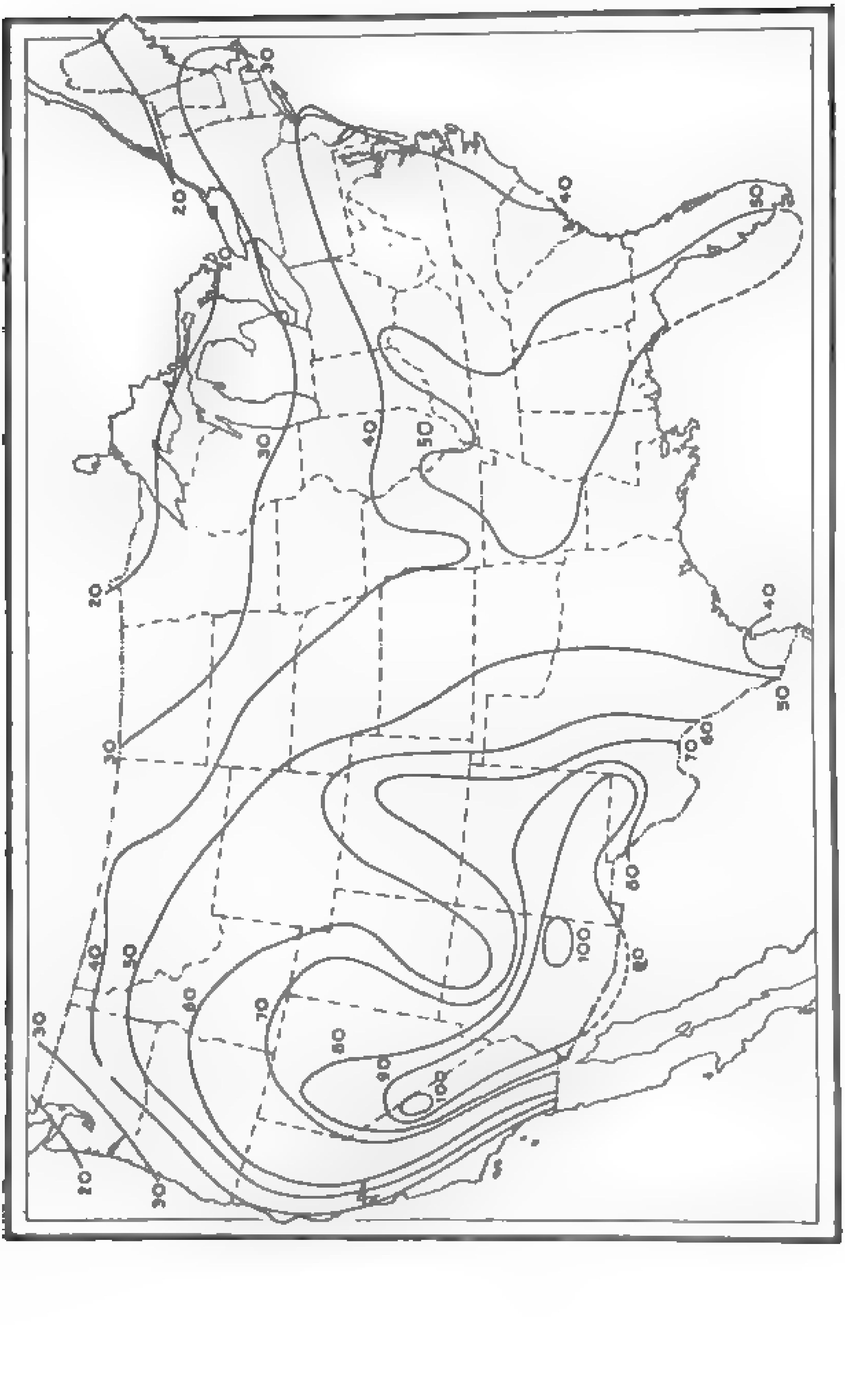
	1880–85, bushels per acre	1907–10, bushels per acre	Increases, bushels per acre
Wheat	24.54	38.55	14.01
Rye	23.86	36.69	12.73
Oats	49.79	81.48	31.69
Winter barley	38.25	57.57	19.32

profitable, easily grown, money crop year after ield becomes low and unprofitable. Then variations (usually with the increase of population and ' this variation is systematic, it is called rotation rotation causes variation in the demands upon es it time to recuperate from the strain of any one ient humus is provided, by the plowing in of ves, manure, etc., and the soil is not allowed to

showing mean annual number of hours of sunshine in the fter Van Bebber.) (From W. S. Tower.) Sunshine has great growth.

riculture may, with crop rotation, continue on the indefinite periods, as in parts of Europe and Asia. of these simple rules of soil preservation has in a ready brought irreparable ruin to many American y in the southeastern states. The keeping of live ype of agriculture which best preserves the soil, nits the return of the manure to the land and thus tain fertility.

past half century there has been throughout the a steady decline in the proportion of the people iculture. The invention of agricultural machinery a given number of farmers to produce a greater


20
30
40
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60
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90
100

g a portion of the population for other occupa-sure, which has greatly increased in these later

ɔr tending to reduce the proportion of farmers is er to the factory of so many operations that were .he farm. Diminishing returns, that accompany

owing the irrigable lands of the United States. (United States Reclamation Service.)

f population, are a factor tending to increase the agriculturalists. Crop rotation, the intensification can increase the output per acre, but rarely the an. When four families support themselves re- a 2,000-acre ranch, as in the American West, or farm, as in the corn belt, or on a 20-acre farm, as in a 2-acre garden farm, as in Japan, there is no ques-

tioning the fact that a Japanese *acre* is the most productiv and the American *family* the most productive family. I the last half century the discovery of new lands and the in

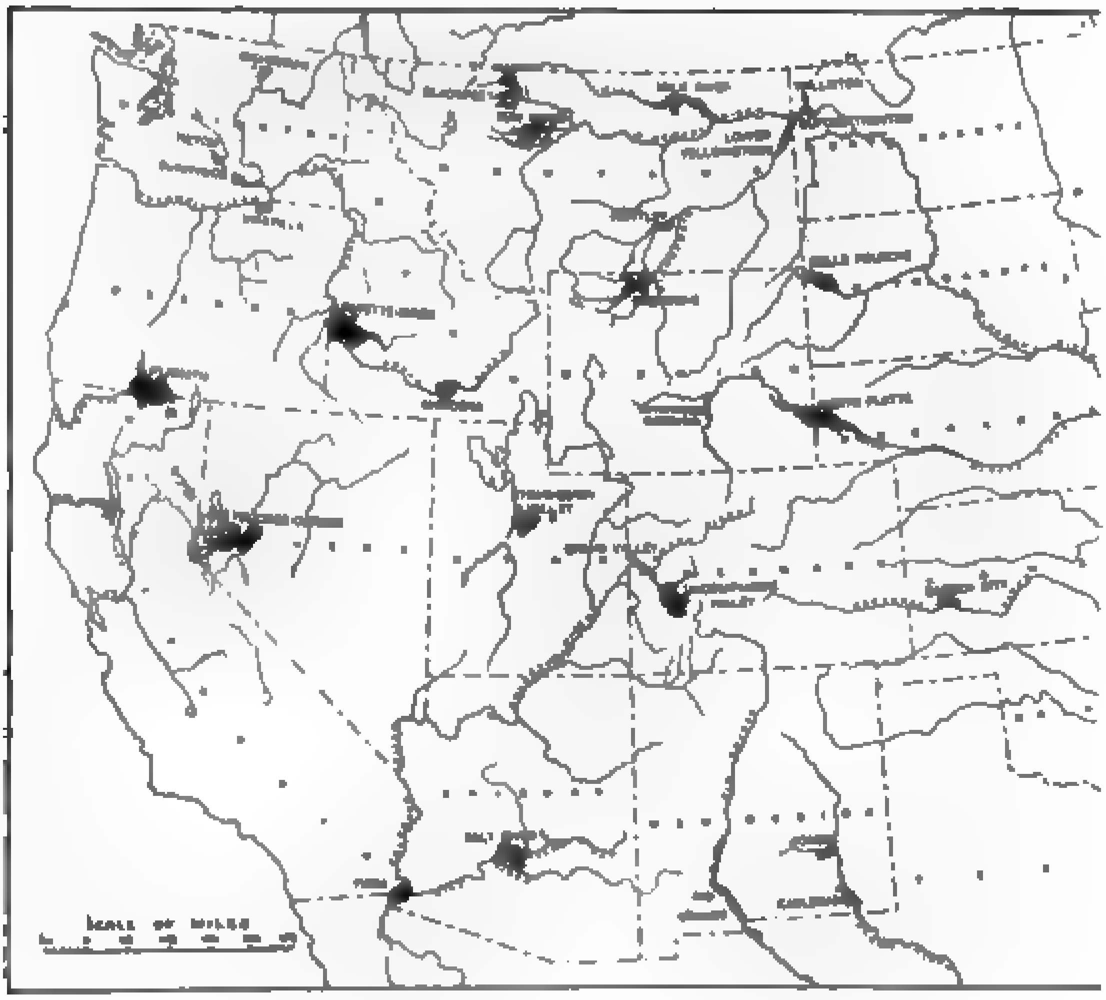

FIG. 19.—Principal irrigation projects undertaken by U. S. Government. Reclamation Service.)

of machinery have been influences that much more than the more fundamental influence of diminishing returns increase of population.

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CHAPTER III

THE CEREALS

ıng ago called the staff of life. Some cereal food practically all peoples in the temperate zone, ȝ the more advanced peoples of the tropics. As :eases in density, meat declines and cereals in- ›rtance as an element in man's nutrition. All ⁾ furnished by the grass family. These plants luten, oils, and other elements of nutrition into provide for the nourishment of the young plant ;s roots well into the earth. This food is equally man and to many beasts, and it is furnished to ı lands by a much larger number of plants than eating nation would at first expect.

I. WHEAT

ad its Climatic Requirements.—Wheat is a grass, ; part of its growth the plant consists of a tuft of Later it sends up stalks of straw that support the ıeads. The number of stalks and heads depends vigor of the plant, and these are greatly dependent tion of cool, moist weather. If the cool, moist ative growth is long, the grass-like development he heads many. Early sunshine that shortens :iod shortens the grain yield. The formative ore important. In milder climates it may include ıere the winters are too severe it falls wholly in l summer. Winter wheat, therefore, the wheat itudes, is sown in autumn and harvested early ner. Spring wheat, the wheat of the north, is and harvested at the end of summer. Although a many and widely scattered lands and different ıst have for the period of its early growth mod-

erate rainfall[1] with rather cool, moist weather, long continue if possible. This must then be followed by warm, bright, and preferably dry weather. Abundance of summer rain is fatal to extensive wheat growth. It causes the plant to make straw rather than grain, and also induces rust and other fungus diseases to attack the plant. If excessive, it causes the grain to shrivel before harvest, and often causes it to mould or decay after harvest. Consequently, warm regions of heavy summer rainfall cannot grow wheat with assurance of good harvest.

This double requirement of a cool, moist formative period and a warm, sunny period of ripening explains the importance of wheat in regions of rainy winter and dry summer, like California and its absence from lands of heavy summer rainfall, like the coasts of the Gulf of Mexico. The rainfall of eastern and southern United States promotes heavy vegetation, permits a rich and luxuriant agriculture, but is quite unsuitable for wheat. A ten-year average for Georgia shows 7.9 bushels per acre, while Wisconsin made in the same ten years 15.7 bushels per acre. Even the corn belt of the Ohio and Mississippi valleys has sufficient moisture at times to injure the wheat crop to some extent, although it is grown in every county and almost every township in the whole region. In the cotton belt with its still greater summer rainfall, so favorable for cotton, wheat becomes less and less possible, and the little that is grown in the northern margins of the east Gulf States and in Carolina has the lowest yield per acre found anywhere among English speaking peoples. The whole torrid zone with its tendency toward summer rain is therefore, practically barred from wheat growing, except here and there where some climatic exception holds sway, as in Egypt, arid, but having enough river water for irrigation, or again, where high elevation, as in Mexico and Colombia, gives temperate conditions to plateaus and mountain regions. The most important of these tropic exceptions is India, where the summer rains, brought by a monsoon, arrive after the wheat has been ripened by the heat and droughts of early summer, thus permitting India to be one of the world's important wheat countries.

[1] The moisture left from a period of seasonal rainfall is sufficient in some parts of the Pacific slope to mature a crop of wheat upon which no rain falls.

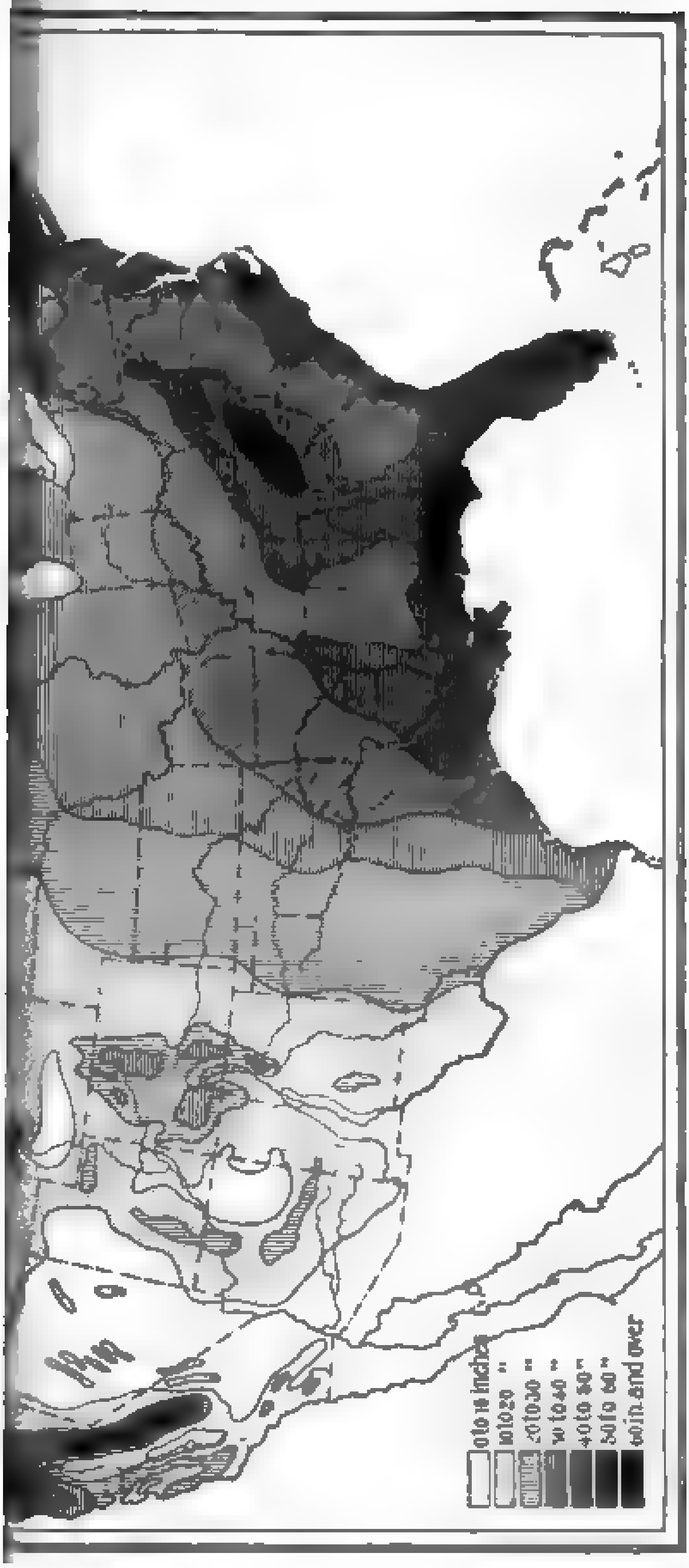


FIG. 20.—Mean annual rainfall in the United States. (After Gannett, from data of U. S. Weather Bureau.) (From W. S. Tower.)

Freezing and Thawing of an Open Winter.—In addition to the handicap of summer rain, parts of the corn belt of the United States have another difficulty in the alternate freezing and thawing of the early spring and late winter. This is much worse than a heavy mantle of snow or even solid and continuous freezing. The expansion and resultant lifting of the top soil by freezing, and the contraction of the thaw, gradually pull the wheat plant out of the ground. As a result, wheat is much

Fig. 21.—Average dates of the beginning of winter wheat harvest. (After U. S. Crop Reporter.)

less important in many corn-belt localities than it was twenty-five years ago. The wheat regions have been shifted beyond the Mississippi Valley southwestward, into a less frosty climate for winter wheat, and also into the colder Red River Valley of the North and to the plains of Canada, where the rigors of the winter climate have no direct effect upon the wheat because it is spring-sown.

th Good Wheat Climate.—The ideal wheat climate, winter and a dry summer, is sometimes called the n type of climate because it is characteristic of s facing that body of water. This wheat climate ontinents in a climatic zone corresponding to the n region and produced by the same elements in nd system. This Mediterranean wheat climate l upon the margins of the six arid or desert regions ch of the six continents in the latitude of transition ones of trade wind and the prevai[illegible] westerly. tion land with rainfall varying fr[illegible] the abundant , and having a winter maxim[illegible]ils along the of the Old World desert from [illegible]ltar through and North Africa, and on both sides of the desert in , and China. We find it again in South America, ert extends diagonally from Peru through northern tern Argentine Republic and is bordered by a wheat west in central Chili and on the east in eastern Argen-. Wheat lands border on the cooler edges of the ith Africa and Australia, but the desert encroaches at lands so much that these regions are unimportant s supply. South Africa even now imports wheat, ralia the moisture suffices only on the eastern, l extreme southwestern sections, and her crop varies the fluctuating rainfall on this desert margin. l is a regular wheat exporter because its location, r the south pole than Australia, permits it to miss canty rainfall which roughly follows the tropics of Capricorn. New Zealand gets instead the regular west wind. Australia gets the rain of Southern nd New Zealand that of Washington state. Like a similar latitude and climate, New Zealand has a eat yield per acre, about 30 bushels, in contrast ushels in southern Australia.

ted States, also, we see the wheat regions distributed the same conditions. The western part of our ut 40 to 45 per cent. of the whole) is mostly too arid n, except when irrigated. The district of greatest the Great Basin. Going from the east toward the

arid region we find close to the line of 20 inches of rainfall the most important wheat belt in America, reaching from Texas north through Oklahoma, Kansas, Nebraska, the Dakotas, and Minnesota into Canada. A second belt is found as we go north and northwest from the deserts of the Great Basin, into an area of increased rainfall, which gives the wheat areas of eastern Oregon and Washington. To the west of the Great Basin, across the Sierras in California, is the great valley of that state, one of the important wheat regions of the country. Its essentially Mediterranean conditions give it the best wheat climate in America.

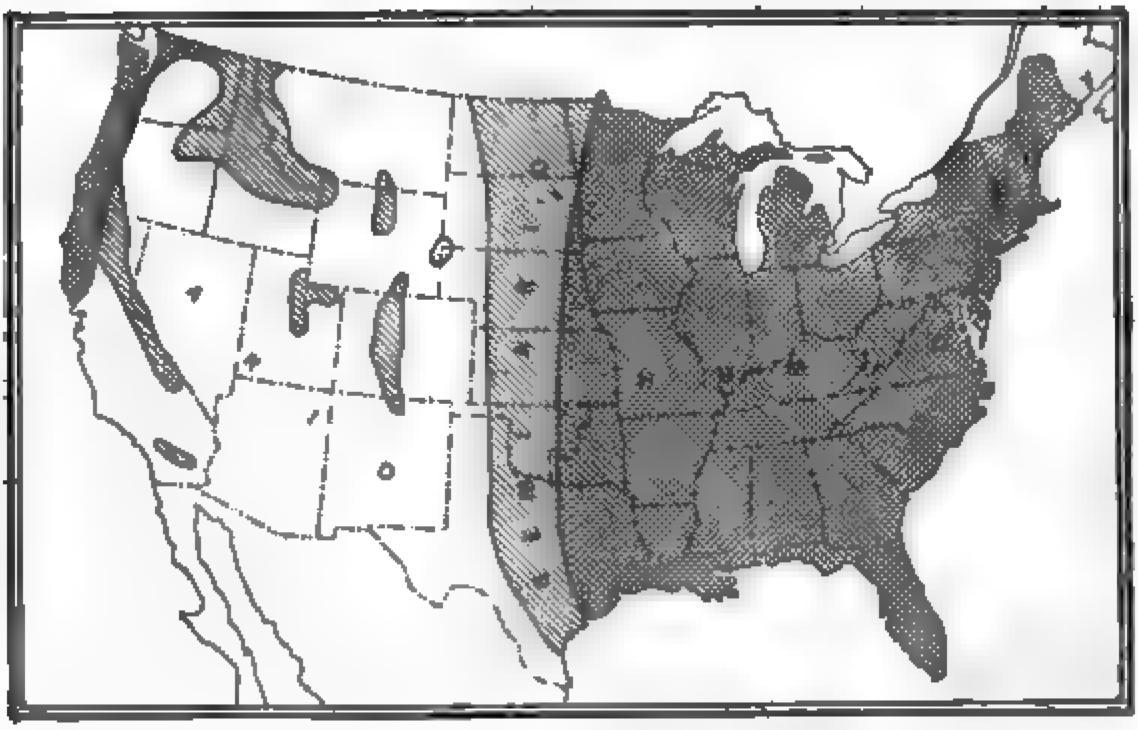
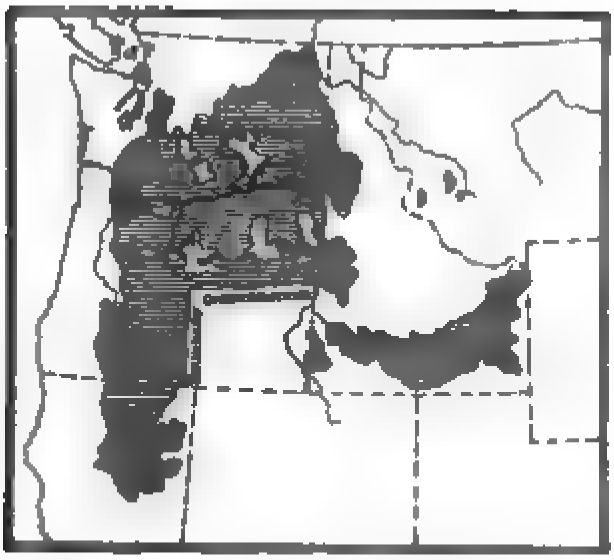


FIG. 22.—Map showing arid, semi-arid and humid regions of the United States. (After Newell.) (From W. S. Tower.) It is interesting to note the small number of people in the arid territory.

In that part of the Mississippi Valley north of Nebraska and its continuation in the plains of west Canada, the winter is too cold for fall-sown (winter) wheat, but a fortunate rainfall distribution permits the planting of wheat in spring. The rather light rainfall (15 to 20 inches) has a maximum in early summer or midsummer which promotes the grassy growth of wheat. The wheat then ripens in the dryer late summer. This makes the plains in the center of North America one of the most promising granaries of the twentieth century. But the promise of great production in the next decades is due more to great area than to any perfection of climate.

n and Breeding of New Wheats.—Still further the world's wheat regions may be expected through of plant breeding and production of new varieties. come into possession of Mendel's Law, the usable of heredity,[1] enabling us to change profoundly st of the other crops grown by man. Progress in should be very rapid from now on. An example rrence in the Northwest is illustrative of the new- that is destined to enrich every land in the world. lains of eastern Washington the practically rainless



a flows of the North-west. (From W. S. Tower.) Basis of very fertile soil, and a large wheat production.

its the farmers to let the wheat stand for a month . The harvesting can accordingly be extended over veral weeks, and comparatively few hands can thus ast farms. It so happened, however, that the best ty permitted many of the grains to scatter out of d fall to the ground before it was cut. The rival eld its grains tightly was so tender as to be injured hree by the frosts, which follow periods of warmth n this land of open winter where wheat is usually ll. An experimenter at the agricultural experiment State of Washington crossed these two varieties, d a third variety which has the frost-resisting e and the grain-holding qualities of the other, thus

[1] ...ism, by R. C. Punnett. Wilshire Book Co., New York, ch current literature.

permitting large extension of wheat growing on the wide fertile lava plain of the Columbia basin, which now averages 23 bushels per acre, while the average of the whole United States is but 13.5 per acre of wheat sown.

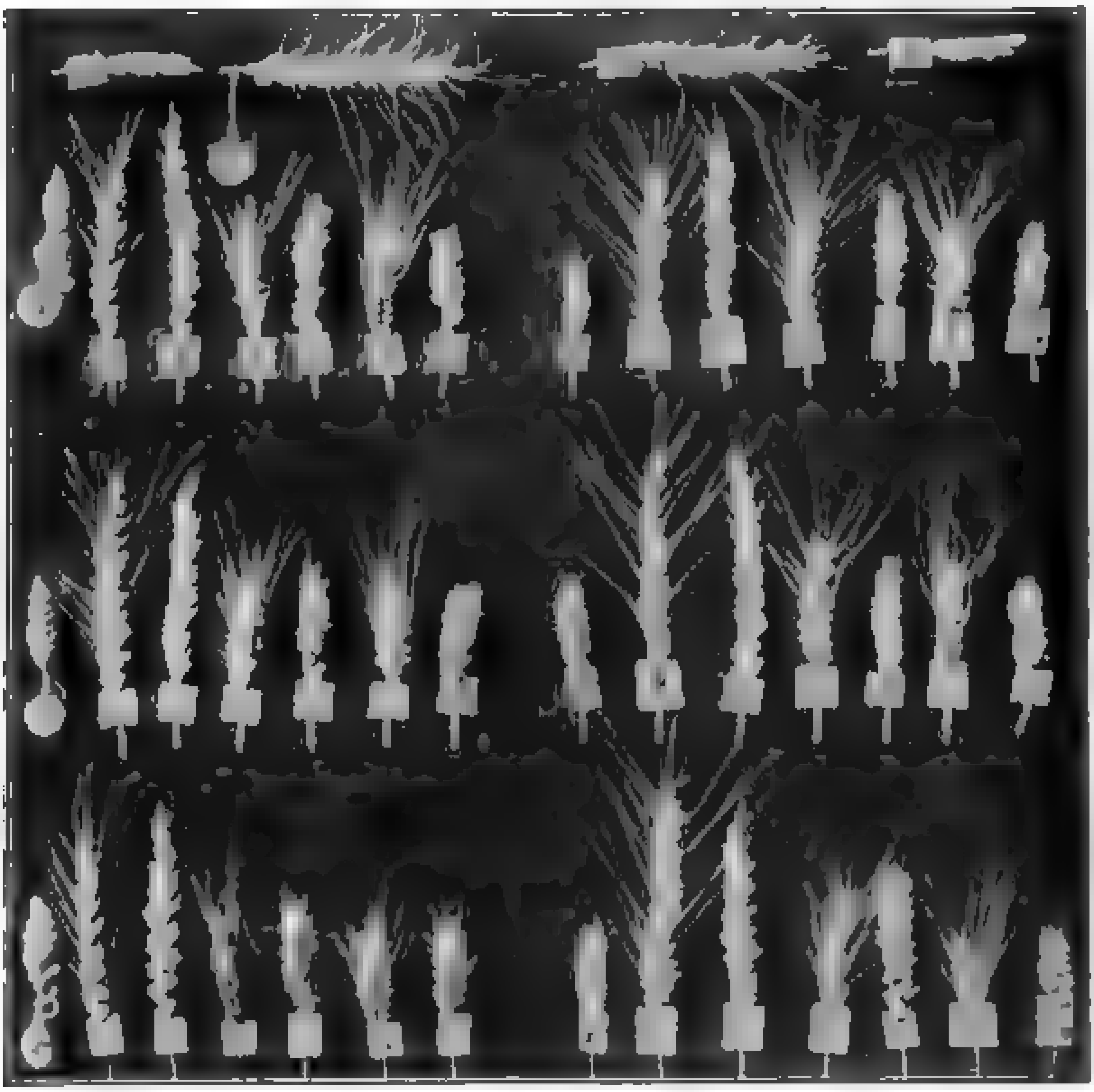


FIG. 24.—An experiment in plant breeding, cross-bred wheat showing great variation in offspring of hybrids.

ab, = parents
a′ a″ a‴ = offspring of abCross
c_1c_2 etc.,
d_1d_2 etc.
e_1e_2 etc } = offspring of a′ a″ a‴

A B = parents same variety as ab but crossed the other way.
A′A″A‴ = hybrid offspring of ABcross.
C_1C_2
D_1D_2
E_1E_2 } etc = offspring of hybrids A′A″A‴

The introduction of foreign varieties has already been very effective in increasing our harvest. The large production of the spring-wheat belt of the United States and Canada did not take place until after the introduction of the Red Fyfe, a variety well

imate. The recent introduction to the United
la of a drought-resisting variety of wheat known
the arid lands of eastern Europe, has caused the
ı of the wheat area into the drier lands. This
contains much gluten and is thus very valuable
;ure of macaroni. More than 50 million bushels
r grown in the United States.
ion of new varieties gives new *materials* for the
to use. Plant explorers are now scouring all
of the world in search of plants particularly
cular purposes and environments. These plants,
ıe quality to the point of genius, can be used as
the plant breeders. For example, in 1910 great
ısed among economic botanists and wheat growers
r of wild wheat (a plant supposed to be extinct)
ırid slopes of Mount Hermon in Palestine. This
h promise for scores of millions of now hopelessly
:es that the United States Department of Agri-
sent an expert to study this plant in its native

Gradual Reduction Process of Milling upon
.—The northern extension of the wheat fields of
merica is largely due to the comparatively recent
ıe process of milling spring-sown wheat. The
at crops and the wheat crops of Eastern United
ys been sown in the fall and harvested at the be-
mer. The spring-sown wheat of central North
r the Red Fyfe, a variety of Scotch origin, is so
ittle that for many years it could not be satis-
l. Because it made poor flour it brought poor
ands upon which it was grown were in low esteem.
of the gradual reduction process of milling made
l-grain the best flour, and gave to the northern
wheat boom which, in the last quarter of the nine-
, caused the movement of wheat-growing popula-
he shifting of wheat growing and the rapid
states in the northern Mississippi Valley and, in
of the twentieth century, caused large gains in
a. This northwestern movement of population

for wheat growing will doubtless continue for decades to come. After a century of westward movement, wheat growing, like the centers of human power, has started northward.

Effect of Machinery in Wheat Production.—The methods of producing wheat have been made much cheaper and easier by mechanical inventions. Eighteenth century wheat was cut in the Scriptural way, by sickle held in one hand of the laborer, while he grasped a few heads of wheat in the other. Then came the cradle invented in New England in 1806. It was a kind of scythe (scythe invented at Lynn, Mass., 1655) provided with fingers to catch and throw into an even row the straw it cut. The cradle was the main dependence of the United States through the first half of the nineteenth century. In 1851 Cyrus McCormick of Virginia made a reaper, which cut and dropped the grain in bundles to be bound by hand. Then came the reapers which also tie the bundles, and finally the reapers that carry the bundles and drop then in piles where the shocks are to be made. One of these machines with three horses and a driver has no difficulty in performing as much work as was done fifty years ago by from five to seven men working arduously with cradles and rakes. As wheat cutting is now merely the driving of horses and the adjusting of levers on the reaper the work is occasionally done by women. Where wheat is grown in hundreds of acres, still more specialized machines are used, the most complicated of which is the combined harvester and thrasher. This machine can be used only when very dry summers, such as occur in the Columbia River basin and the great valley of California, permit the grain to dry out on the stalk so that shocking it up to cure it is not necessary. Here the combined harvester and thrasher, driven by steam or drawn by twenty-five or thirty horses, sweeps over the great fields and daily puts into sacks the thoroughly dry grain of thirty acres of waving wheat fields.

Similar improvements have been made in thrashing, which is equally a part of wheat production. Men are still living in the United States who in their youth helped thrash by driving horses around and around upon the sheaves that their feet might shatter out the grains upon the thrashing floor. A method similar to this, in which the horses drag a rolling stone around the thrashing floor is still in use in Russia, Turkey, and other coun-

the Black and Mediterranean Seas.[1] In more
ns, under the influence of high wages, the steam
arly all the work. In the United States, it is
of these machines to thrash a thousand bushels
y and be taken at evening to the next farm by
a engine. These revolutionary improvements
ation have cheapened its labor cost from 133
n labor per bushel in 1830 to 10 minutes in 1904.[2]

rashing floor of type common in eastern Mediterranean countries.

y for planting, harvesting, and thrashing wheat
opted, with minor changes, to do the same work
mall grains—rye, oats, barley, and buckwheat.
that results from the easier production permits
more universally used as food. It is now eaten
e in the southern United States who previously
se of corn; by others in Germany and Austria,
ving on rye bread; and even by the Chinese and
re increasing their use of it as a luxury to replace
heaper foods of barley, rye, millet, and the more

e often unroofed, and by Turkish law the grain cannot
hem until the tax gatherer comes. Meanwhile birds,
er injure. Bribe, if sufficiently large, may induce the
rry. This is typical of the many ways that the Turkish
industry.
artment of Agriculture, 1910.

Yield and Production of Wheat in New Countries.—It is . peculiar fact that the world's greatest wheat exports are pro duced in regions of comparatively low yield per acre, and in region that do not have the ideal wheat climate. (See Table of Whea Trade and Production, p. 55.) This is because wheat where i can be grown in treeless countries is a good frontiersman's crop With the aid of modern agricultural and transportation facilitie wheat is a money crop easily grown. It has good keeping quali ties, is easily shipped, is in universal demand. It is of mor

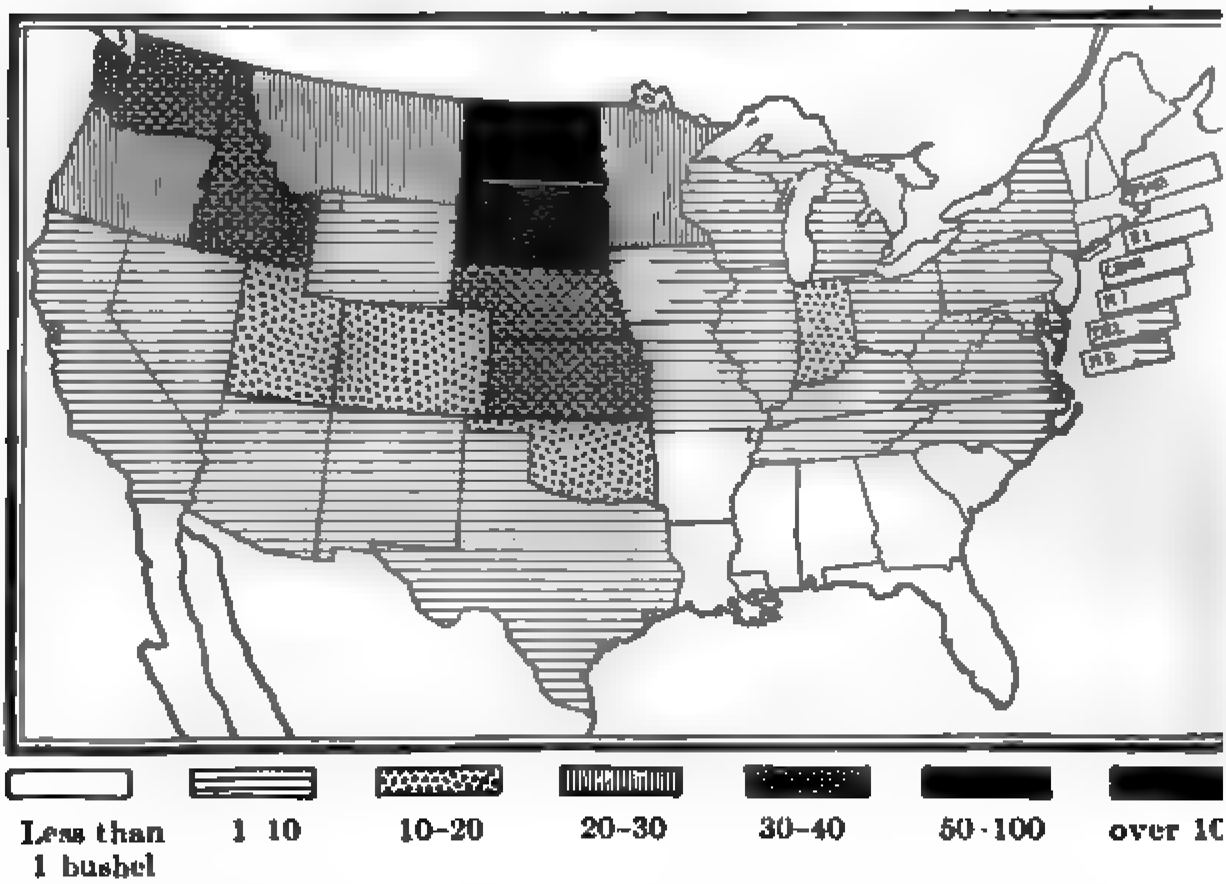


FIG. 26.—U. S. production of wheat per capita, by states. Wheat figures, three year average, 1909–11. Pop., 1910.

value in proportion to its bulk than hay or any temperate zon grain. It grows well in a greater number of places than eithe corn or oats. Once it is safely sheltered near a railroad, it can b marketed many months later, thousands of miles away. Thes advantages of wheat as a money crop often make it the firs and most profitable thing that can be grown by the new settle upon an open plain after the railroad is within reach, eve though the average yield per acre be low.[1] As the last hal

[1] The distribution of the world's wheat crop is a fine illustration of th fact that products are often grown in places that are not best suited to then This does not prevent the crop from being the best thing to grow on thes lands.

n an epoch of settlement and railroad building, f wheat exports for that period have been grown y accessible plains: in the Mississippi, Missouri, valleys of the United States; in western Canada, Republic, Russia, and Siberia. Owing to the is no rival cultivated crop, the settler on a new ender of flocks, usually grows wheat year after the yield will be at all profitable. Illinois and ssed through this exploitation or continuous which prevails at the present time in the more

evators at West Hope, N. D., a railroad station on the ontier near the Manitoba boundary, longitude 101° W.

ands of central Kansas and Nebraska and Okla-. The Red River Valley of the North, comprising of the wheat districts of Minnesota, North Dakota, like the black earth districts of southern Russia, s decline in yield and approaches the end of its at production. With the possible exception of ck earth belt there never was in the whole world than the Red River country for the growth of ertile plain, the bed of a glacial lake, often for s flat as a floor, without a stone or tree, lends to the use of the most modern machinery and duction. Year after year wheat has been grown

until the declining yield has made the farmers turn to other crops—the raising of horses, the keeping of cattle, the making of butter. The total yield from these districts does not decline because of the steadily increased percentage of the land that goes into wheat in the one-crop period and the improved yields that follow the introduction of crop rotation and livestock.

At the present time in western Canada, where new railroads are being built across open, empty, treeless plains, the new settlers are again beginning with continuous wheat growing which will last them one, two, or three decades before they too must take to other crops and cattle keeping. In the meantime these wheat crops on the virgin prairie soil of the harvest frontier are larger than those of the Red River Valley. It is possible that the Canadian region suitable for the extension of wheat growing reaches 60° north, and extends from Lake Winnipeg to the Rockies. If experience proves this to be true, the wheat-growing possibilities are enormous, and the continuous cropping method will have land to support it for several decades.

The Italian farmers, who are now going to the Argentine Republic at the rate of 100,000 per year, are having an identical experience upon the magnificent black soil plains that lie along the western banks of the Parana River. The Russian peasant also exploits in the same way when he emigrates to central Siberia and settles on those endless plains called steppes where now the trans-Siberian railroad has made possible the export of grain. After a time these Siberians also must rotate crops, keep cattle, and export butter and eggs to London, as do their brethren in the older and more developed lands of Russia and West Siberia.

While important for the frontiersman, wheat is also important in established crop rotations and mixed farming for two reasons. It affords an easy way to start pasture and hay fields because the young grass can grow up as the wheat grows, the wheat serving as a nurse crop. Among keepers of livestock the straw is valuable for bedding for the animals. Wheat thus becomes as essential in the semi-garden agriculture of Belgium as it is on the new plains of Canada and Siberia, and the greater care and labor hold the total production at a high figure.

Effect of Cheap Wheat on Farm Value in Old Countries.—These new lands upon the plains of North America and other

opened up by railroads, and often actually his made the production of wheat a much in these lands than in Europe, where rent and value is high. With wheat production made machinery, it has become so cheap that, espe- later years of the 19th century, it was no longer w it on much of the land in the eastern United ern Europe, particularly Great Britain, where the mainstay as a money crop. Animal prod- apened by the same forces. Accordingly in both regions. Many farms have been aban- England and New York, while many thousands t the North Atlantic slope would sell for less e was a mile of railroad in America. New York 2 million bushels of wheat in 1839 and 6 million

AT TRADE AND PRODUCTION (1910)

countries			Exporting countries			
on bushels		Yield in bu. per acre, 1909		Million bushels		Yield in bu. per acre, 1909
,	Import,[1] 1910			Crop, 1910	Export, 1910	
	49	40.0	Argentina....	146.0	75	10.4
	5	37.8	Australia.....	98.1	64	12.3
	22	21.8	British India.	369.6	42	10.9
	67	30.5	Bulgaria.....	48.0	11	12.4
	42	16.3	Canada......	215.8	60	21.5[2]
	3	20.8	Roumania....	90.9	32	13.6
	21	32.8	Russia.......	447.0	23	14.2
	14	34.2	United States	621.3	61	15.8
	217	34.3	Average of exporting countries...	......	....	13.8
			Kansas.....	51.4	....	14.4
..	....	29.8				
..	....	21.0				

r.
anadian average was 16.1 bushels per acre.

COMPARISON OF CROP AND YIELD IN EUROPE AND AMERICA

America is such a heavy exporter of wheat that it is something of a surprise when we first learn that Europe produces much more wheat to the acre and more wheat altogether than America or even the rest of the world. In 1910 the figures for Europe were 1,800 (in 1911 1,952 million bushels), for North America 855 million (849 in 1911), and 3,516 million for the entire world. Europe and the United States do not differ greatly in size, but one has 90 million people and the other 420 million. In order to get enough to eat the Europeans must till their land thoroughly. While the wheat farmers on the cheap lands of Kansas, the Argentine, or the Red River Valley of the North are by their careless but inexpensive methods getting less than 12 or 15 bushels per acre, from land worth from $10 to $40 per acre, the careful English farmer, with a systematic crop rotation, is averaging 30 or even more per acre on land worth $200 per acre. The English tenant farmer does not make proportionally large profits because he has to pay high rent and his higher yield requires much expense for labor and fertilizer.

European Wheat Growing.—The hills and the rain of northern and western England and Scotland and Wales, and the rains of Ireland cause wheat growing to be of small importance in those parts of the United Kingdom.

Eastern and southern England are the chief British wheat districts. With their suitable climate, level plains, and fertile soil these districts are about equal in output to any corresponding area of the United States. England with 50 million bushels in 1908 exceeded as a wheat grower any state east of the Mississippi River and had two and one-half times as much as Missouri, a state of practically equal area. France, with only one-sixth as much tillable land as the United States, has a wheat crop double that of Germany and half that of the United States. French farms average 20 acres each and those of the United States average 150 acres. Stimulated by a high tariff the French farmers make their country more nearly independent in wheat than any other country of west Europe. There has been great increase in the wheat yields of Europe since 1840. Bel-

t manufactures and the densest population in accompanying agriculture so productive that of 13 million bushels was greater in proportion ı that of the leading American wheat states of ota, or North Dakota. Holland and western ermany are also important wheat growers in heir area, and the crop is carefully tilled; yet ufacturing population of these northwestern ope consumes much more wheat than the fertile elds produce.

ı wheat grower, who gets twice the American ı-priced home lands with their high rental, usu- ı methods if he emigrates to the plains of the Argentina where land is cheap, and grows wheat eap land way of the industrial frontier. The repeated within the United States. Old states h an average yield of 22 bushels for 1910 and 21 l) have, through good care, a higher wheat yield ıins states where North Dakota, a leading state, 8.2 bushels per acre in 1910 and 8 bushels in 1911. ɜrranean countries of Spain, Portugal, Italy, and the climate is ideal for wheat, it is the chief percentage of tillable land is small owing to the ' the country, the yield is lower than in north because of inferior methods, and the amount ; sufficient for the very dense population. Yet million bushels of wheat per year on 110,000 area produces 50 per cent. more wheat per 1,000 ın any American state.

eat Exporters.—Southeastern Europe is the only ıtinent having a wheat surplus for export. The lains in Hungary and Roumania, in the Danube Black Sea Basin of Russia, are given over to the ɜat as the chief money crop. During the four European Russia averaged 589 millions of bushels the United States had 651, but the Russian d 142 (1907–10) million bushels, while that of tes was only 116 million bushels. During that ia exported from one-fourth to one-half as much

wheat as the United States. Steamers by the hundred load at the ports of Galatz, Braila, and Sulina on the lower Danube and at Odessa on the Black Sea and discharge their wheat cargoes at Palermo and Naples, at Genoa to feed the people of northern Italy and Switzerland, at Marseilles for the people of France (in years of short crop in that country), at Barcelona for the Spaniards, or at Hamburg and Rotterdam for the factory workers of the lower Rhine Valley and Berlin. Britain also draws much wheat from Russia.

Asiatic Wheat Growing.—While wheat is grown from Smyrna at the west of Asia to Vladivostock at the east, the small population clustered thickly upon the oases of Arabia, Persia, Turkestan and other arid interior countries grow only limited quantities for their own use. In the north of China, also, great quantities are grown and consumed by the natives, but there are no crop statistics. An American Consul reports (U. S. Con. Rep., Feb. 23, 1911) as the results of a journey through central and western China in 1910, that wheat is extensively grown there. He saw fine wheat fields in the Hoangho basin that would yield over 40 bushels to the acre. He thinks the region north of the Yangtse Kiang and west of the rice-growing plains near the coast, contains more wheat eaters than the United States. He estimated the crop of the two provinces of Shansi and Shensi at 50 million bushels. New modern flour mills (owned by Chinese) are rapidly making Shanghai a center of flour export to the Chinese coasts and the import of American flour fell off heavily from 1907 to 1910.

India in bad years eats her crop and in good years has an export which equalled 26 per cent. of that of the United States during the years 1907–10. The Indian wheat is chiefly grown in the dry Indus Valley and on the plateau near Bombay. Practically none is grown in the Ganges Delta or on the coasts of the Peninsula.

There is little doubt that the great Siberian plain reaching nearly all the way from Lake Baikal to the Urals, and closely resembling in its black flatness much of the Canadian wheat country, is the most promising future wheat exporter of the Old World. Siberia and India are the important wheat exporters of Asia.

wheat crop is equal to about one-tenth of her
wheat crop of Ohio. There is much interest
ry that there is room for the extension of wheat
parsely peopled north end of the Japanese Em-
, for example, long considered hopeless, is now
winter wheat possibilities.

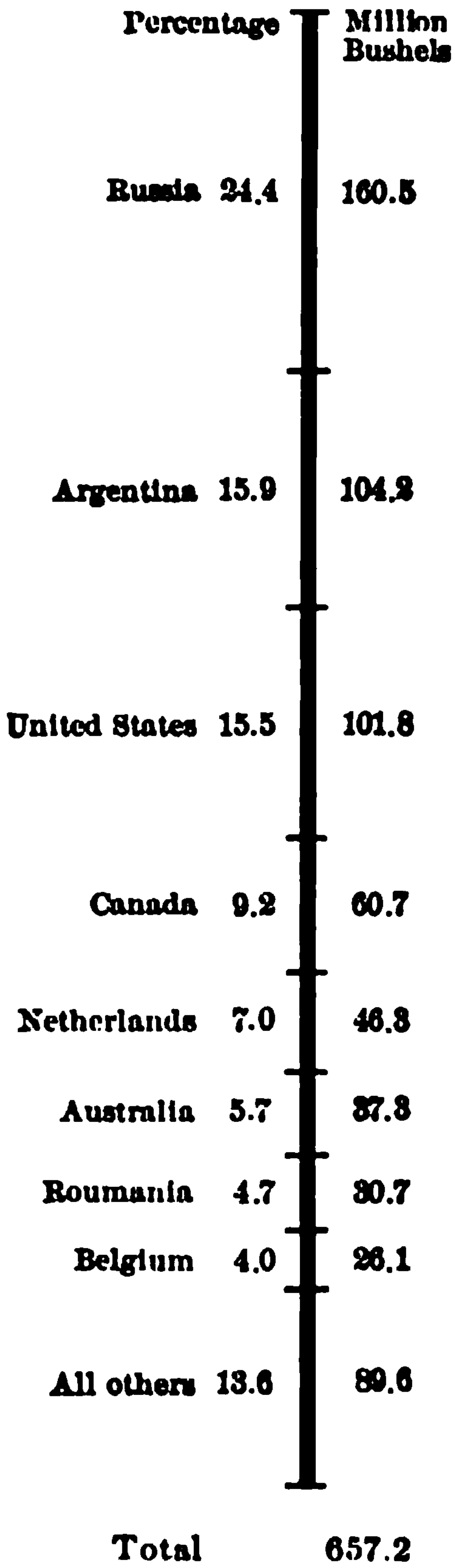
the only place in Asia outside of Siberia having
ossibilities. An American agricultural expert
of the Chinese Government estimates that the
ie now relatively empty wheat lands of Man-
rn Mongolia should produce by native methods
00 million bushels. American flour has disap-
e Mukden market, but there is no reason for
:t to consume much or any of the prospective
ieat. The large and increasing population of
ow importing some wheat, will probably take

ing Countries.—An examination of the table on
d production will show that the chief wheat
ne manufacturing peoples of west Europe, and
supplies come from southeast Europe, central
Argentine, Australia, and India. International
; reveal what is likewise a fact, that the entire
ie Appalachian Mountains in the United States
manufacturing countries on the other side of
awing large supplies of wheat from the agricul-
l. It happens that a shipload of wheat from
falo is domestic (naturally uncounted) trade,
rom the Danube to the Rhine or to Barcelona is
Europe and the United States are much alike
nds of production, but differences in statistical
hide it.

Vheat Exporting Regions Compared.—The wheat
ithern Europe, on the Black Sea, share with the
e Argentine Republic the advantage of cheap
tation. The wheat exporters of the United
iada grow their surplus for export in the heart
a thousand miles or more from seaports. That

p., Feb. 23, 1911.

this last region nevertheless takes its place among ex regions is due solely to the excellence of the transport conditions which have made possible the bringing of whe ocean harbors where it could be exported. In 1825 the Canal connected the Hudson River with the Great Lakes



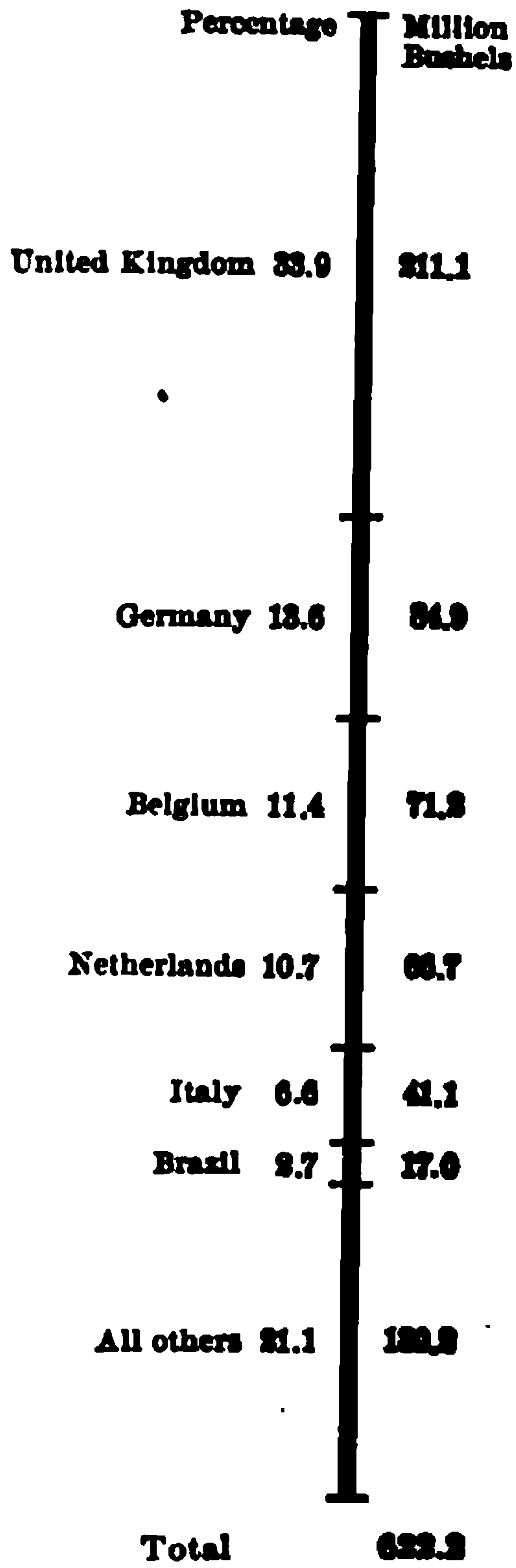
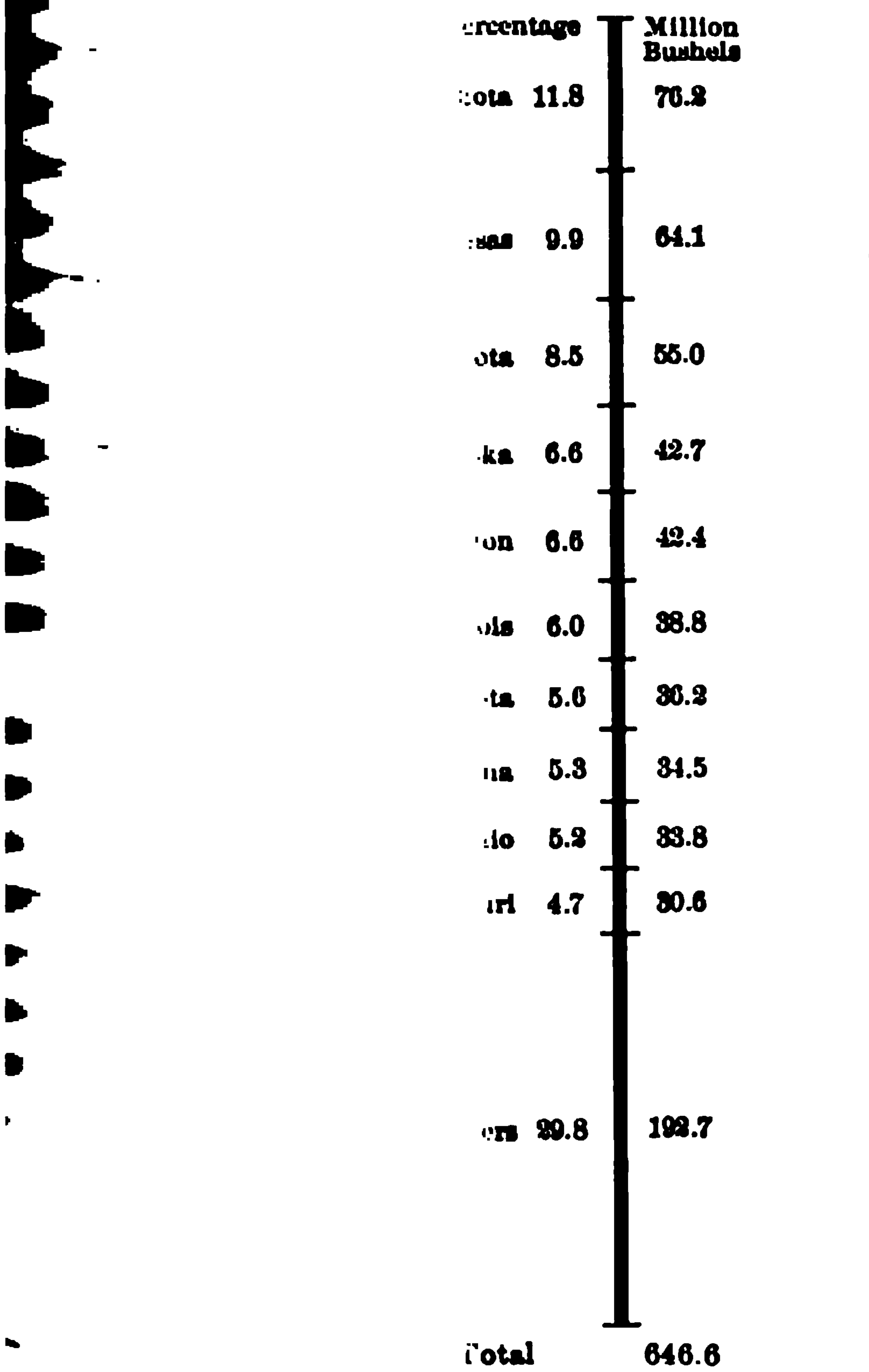


FIG. 28.—Wheat and wheat flour exports, three-year average, 1908–10.

FIG. 29.—Wheat and wheat flour ports, three-year average, 1908

made possible boat transportation from the shores of the G. Lakes to New York at a fraction of the previous cost. made possible the extensive growing of wheat in western York, northern Ohio, Michigan and other lake shore distr. Ohio ranked first among the wheat-growing states in 1 Twenty-five years after the canal opened the lake

·ut there is now in
of both wheat and
·ives a smaller and
furnishes an inter-
once a great wheat



heat production of United
o-year average, 1909–11.

·eage in 1893. Since
· have cut in on the

t declines, we are likely
·th century, the exports
.ncrease because of the

waterfalls at Rochester and Niagara Falls, both being close to the Erie Canal, led to the early development of milling on a large scale; but these centers have long since been eclipsed by the great flour mills of Minneapolis, the greatest flour manufacturing city in the world. Here the falls of St. Anthony on the Mississippi River give power for driving the machinery in a location very convenient for the assembling of the wheat from the northwestern fields of the United States and Canada. From these Minneapolis mills flour is sent to all the cities of the northern and eastern United States and western Europe.

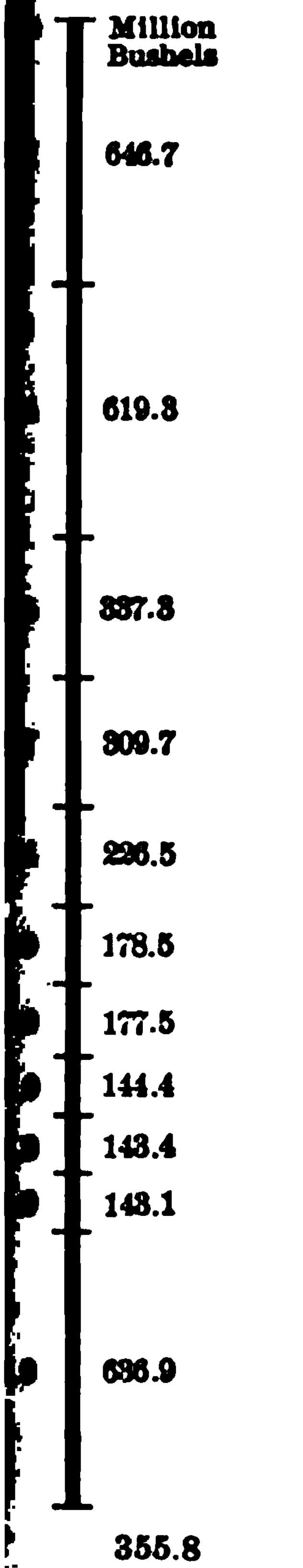
In various towns along the route of wheat shipment from the Mississippi Valley to the sea there have sprung up manufactures of prepared breakfast foods, an increasing form of cereal consumption. These, however, use other grains by themselves or in combination with wheat.

The chief by-product of the American flour mills, bran, the outer covering of wheat, is used as stock food, especially for dairy cattle, in the same populous regions that buy the flour. It is interesting to note that China has so few domestic animals that the flour mills of Shanghai are handicapped in the disposition of their by-products.

Wheat in American Foreign Trade.—Wheat has been important in the foreign trade of the United States for two centuries and a half. As early as 1656 the traders of New York rejoiced over their shipments of flour and bread to the West Indies, where wheat could not be grown. A century ago, during the Napoleonic wars, American wheat helped to feed the European armies and wheat export was a most important part of our foreign trade. Land values of American farms and the location of population depended greatly upon the ability to get wheat to the sea by wagon or flat boat. (See population map of 1800 and 1810, U. S. statistical atlas.) Throughout the whole of the nineteenth century wheat was the leading agricultural export of the north; and there is to-day, in addition to our heavy trade with Europe, a widely scattered trade in flour with the West Indies and other tropical countries, where some flour is used and little or no wheat is grown.

The future, however, promises to see our export of wheat decline in importance and in quantity. Our export of wheat

ivor of flour exports. But there is now in ous decline in the export of both wheat and increasing population leaves a smaller and other lands. California furnishes an inter-his change. That state, once a great wheat



eat production, , 1909–11.

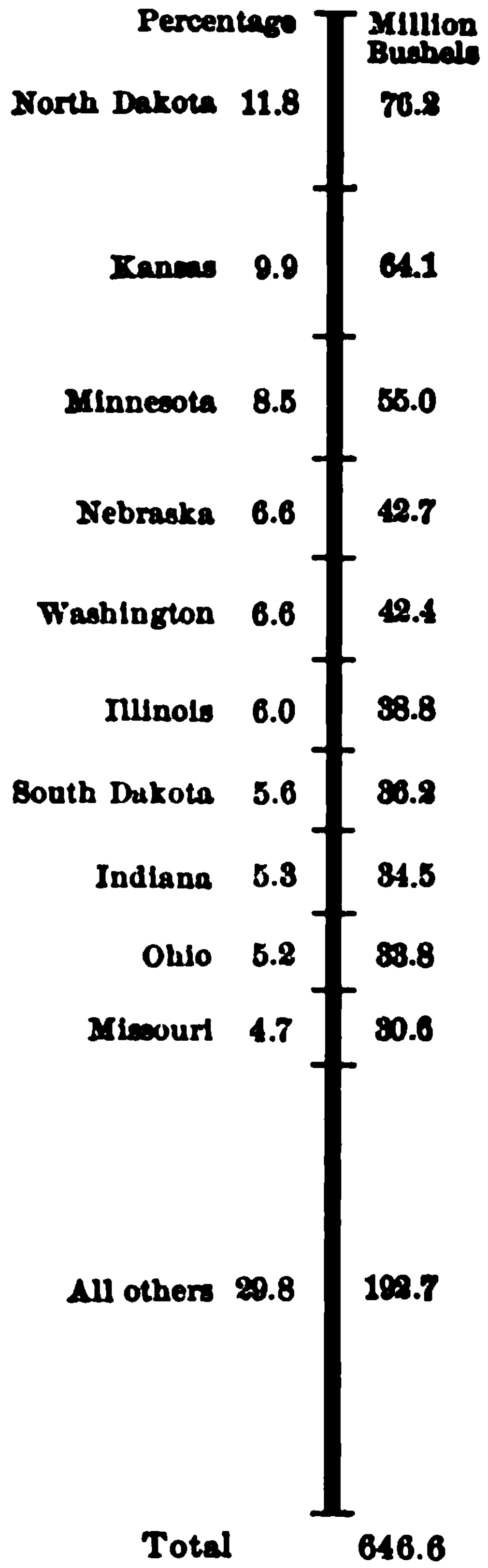


FIG. 31.—Wheat production of United States, three-year average, 1909–11.

her maximum wheat acreage in 1893. Since fields and fruit orchards have cut in on the

at Supply.—As our export declines, we are likely first third of the twentieth century, the exports Argentine Republic increase because of the

large area of level plains of these countries, new to the plow, fertile, and sparsely populated—just the kind of place for wheat growing by the one-crop method which produces large yields for a short time. Already the Argentine wheat exports of about 100 million a year about equal our combined wheat and flour exports. The proportion of the crop exported is significant. In 1910 the United States exported 9 per cent. of the crop, Argentina 52, and Canada 28. Canada's rise is indicated by the yield of Saskatchewan—4 million bushels in 1900, 34 million in 1908. There is as yet little reason to modify Dr. Saunders' reasonable prophecy of 1904—that wheat grown on one-fourth of the land suitable to it in the Canadian North-west, with the acre yield of Manitoba for the previous decade, would bring a crop of more than 800 million bushels, which, as he shows, would feed 30,000,000 people in Canada and three times supply the import need of Great Britain. The remaining three-fourths of the land would provide room for a vast animal industry with soil enriching crop rotations.

2. RYE

Rye Compared with Wheat.—Botanically, this plant is closely allied to wheat, which it resembles in physical appearance. It will grow where wheat grows. But the grain is smaller, less nutritious, and hence less valuable. It is, therefore, almost entirely absent from all of the important wheat regions of the world, and is primarily the grain of poor lands and the food of poor people. The straw is longer than wheat straw and because of its value as packing material the rye grower is sometimes able to sell it for a good price, but this advantage is relatively unimportant. That rye is grown, nevertheless, is due to the fact that a crop will mature in poorer ground, in a colder climate, and with less care than will wheat.

Uses.—The chief use of rye is as a breadstuff, primarily for people with a low purchasing power and consequent low standard of life. Where the land is poor and weather cold, the people are also usually poor, and the cheap rye is the breadstuff of the masses. For example, in central, north, and northeastern Europe rye is the chief breadstuff of the poorer people, as Indian

;rain of the warm lànd, is in parts of south ;o.

uction.—The region of the world's greatest rye ;he low plain of north Europe reaching from nnel through Holland, Belgium, Germany, ussia to the Ural Mountains. Owing to the which once covered this part of Europe, the aces sandy and poor. Here rye grows better ssia grows more rye than wheat which ex- ;xport of wheat, as the people eat the rye. duces more than half of the world's rye crop, han a fourth, Austria-Hungary more than a 'nited States with its 30 million bushels less Germany grows three times as much rye as ısants and factory workers of rye-growing most of it in the form of black bread, which, ly as nourishing as wheat bread. But these substitute the superior and more highly bread for rye bread, when they become able

ith little care and on rough ground, rye was important in the earlier days in the United settlement of the level west, than it is now. me we produce in this country only about one nuch rye as wheat—chiefly in the mountain poorer and hillier lands, and almost never on yield a good crop of wheat. The chief centers 'e the Appalachian region from the Potomac Lake Champlain and the glacial districts be- ılis and Lake Michigan. As the conditions resemble those of the eastern United States, similar extent there.

ndpoint of crop rotations and farm practice, rley are similar to wheat.

3. OATS

duction.—The soil requirements of the oat plant nose for wheat. In its climatic requirements it as much heat, but being nearly always spring

sown it has a later growing season and requires more rain and will also grow in a colder climate. Its moisture requirement bars it from the Mediterranean climates with their hot dry summers. Because of these qualities, it is grown to some extent in very nearly all the important northern wheat regions and also in rye and northern barley regions. It is of the greatest relative importance in such cold, damp countries as Ireland, Scotland, Sweden, and Norway, and is grown to a great extent also by the people of the central and eastern European rye belt. It is also important in the eastern half of Canada, where the climate is too cold for corn. In the colder northern parts of Corea and Japan where rice does not thrive and wheat is not at its best, the farmer resorts to oats and barley.

Uses of Oats.—The Scotch, probably because of their moist climate, have most largely utilized the oat as human food. Dr. Johnson's famous English dictionary is said to have defined oats as "food for men in Scotland, horses in England," to which the Scotch replied, "And England is noted for the excellence of her horses, Scotland for the excellence of her men." The people of other countries are now, since the coming of the breakfast food habit, learning to eat more oatmeal. A little oaten bread is used in parts of north Europe, but the main use is as horse food.

Grown on Same Farm as Indian Corn.—The fact that oats may be sown in spring and will stand the hot summer makes them a very important grain in the corn belt of the United States. In much of this territory the summer is not fully suited to spring-sown wheat, and the alternate freezing and thawing of the open winter often injures winter wheat. Oats, not being hurt by a little frost, fit nicely into these climatic and agricultural conditions by being sown very early in the spring before corn can be planted. They require no attention until harvest time, which does not occur until after the corn has been planted and received all the cultivation that is considered necessary. Then while the corn is maturing, after the hay harvest or possibly before it, the oats are harvested. The excellent way in which these crops dovetail together makes the field of oats as well as the field of corn and the field of hay a part of the great corn belt farm system, and here is grown the greater part of the United States crop, which amounts to nearly a billion bushels.

tates leads in the production of oats. The
.bout equal to that of the United States and
t of Germany, the third oat producer.

Weight on Export.—The oat grain has a thick,
husk which is not removed by thrashing. It
rain if used for animals and only removed by
when the grain is prepared for human food.
utes to cause a great variation in the weight
rom 25 to 50 pounds per bushel, in great con-
variation commonly found in wheat and corn.
weight of oats is 32 pounds per bushel. The
it of value is one of the reasons for the small
e United States amounts to less than a twentieth
. Another and greater reason for the small
rica is the great importance of oats in the agri-
n-importing countries of Europe.
s up an important part of the American export
rs of manufacture being in a number of small
d other corn-belt states, from which the familiar
boxes go out in millions, while the more eco-
d barrels also take their share.

4. BARLEY

nge, and Hardiness of Barley.—This is the
important cereals. The wheat limit in Russia
ersburg, but barley goes on to the Arctic. It is
to the sledge-drawing reindeer and the desert-
In the appearance of the growing plant and of
s close resemblance to wheat. Under similar
ns the yield per acre is much greater than wheat,
ge of wider climatic range. Barley is important
way and Sweden, and in the adjacent Lapland,
h the midnight sun, and ripening 150 miles
tic Circle in 70° north latitude. It is regularly
d and north Russia to the shores of the Arctic
bility to resist droughts and heat causes it to be
uth as the Nile Valley, Abyssinia, and the east
near the equator.

Uses.—An essential element of bread-stuff for general use is gluten, which permits the making of the sticky dough necessary to light bread. But for its shortage of gluten barley would probably replace wheat as our dominant breadstuff and with the new knowledge of plant-breeding such a change may yet be possible. The large yield of barley in combination with its ability to resist drought made it the chief grain food of the ancient Hebrews, Greeks, and Romans, who had rather dense population in lands with a very dry summer (Mediterranean climate). At the present time it is used as breadstuff in Scandinavia, Russia, Germany, and to a less extent in southeastern Europe,

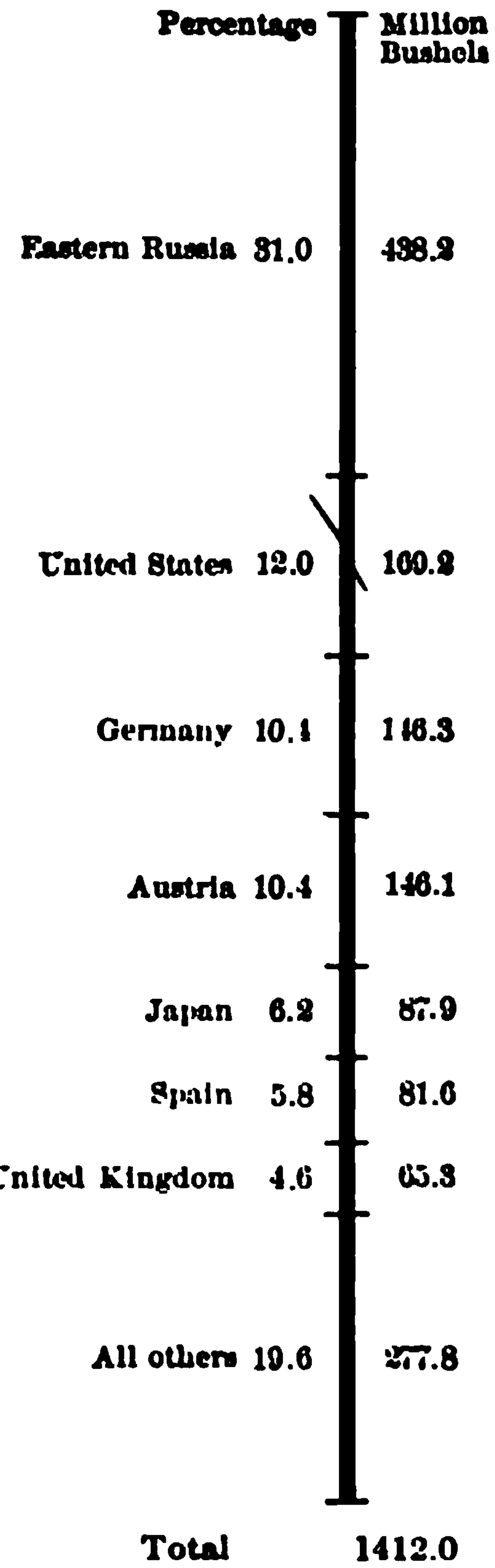


FIG. 32.—World's barley production, three-year average, 1909-11.

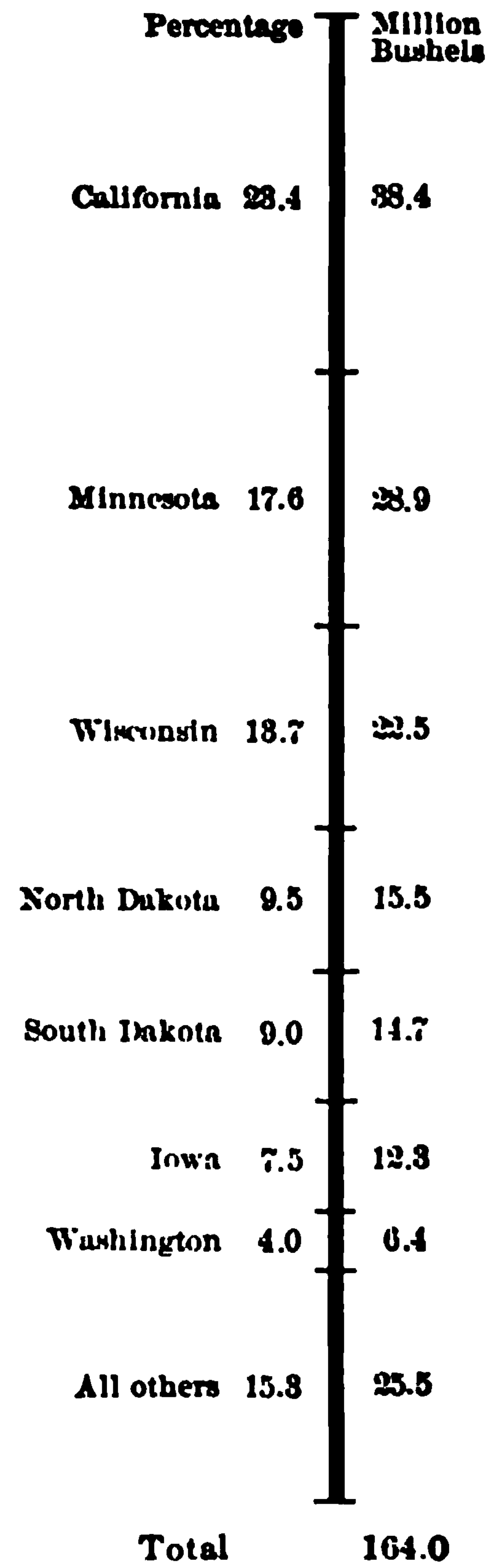


FIG. 33.—United States barley production, three-year average, 1909–11.

be used in the United States to a small extent
of breakfast foods. The shortage in gluten
:e sticky dough and light bread limit its use
h high standards of living chiefly to the making
or which it is extensively used in Germany,
~~Jnited States.~~
makes barley a substitute for corn as a food
ıd cattle in countries that cannot grow corn,
ıd Europe north of the Alps and the Pacific
States. In England and Germany it occupies
;he farm land as wheat, and to a considerable
ıme place in farm economy that corn does in
belt.

Arid Lands.—The drought-resisting quality
›rtant in arid lands, such as those around the
a, Asia Minor, central Asia, Australia, and
it will grow nearer to the desert than wheat.
ıg this winter rain and summer drought kind
lly in such horse-loving countries as Australia
e barley is often made into hay by being cut
mature. At this time the entire plant makes
ılifornia, the barley crop is double that of wheat,
replacing as a market grain, probably because
ht-resisting quality—a factor of great impor-
ith so much arid land. Most of the California
e eastern states for malt manufacture. As in
ırnia, so it is important in Spain and Algeria.
ifornia, with 40 million bushels (25 per cent.
op in 1911) the only barley district of impor-
:d States is in Wisconsin (Milwaukee is a brew-
ıern Minnesota, and the Dakotas, where half
crop is grown. The fact that barley ripens
t is a factor of very great importance because
ıe food for man, the other food for beast, do
ıe growers' time at harvest so that he can grow
two grains than he could of either alone. The
ırn as a forage plant in the United States
ɑited the total growth of barley in this country
ion bushels, about one-fourth as large as the

wheat crop), but the almost cornless Europe grows a billion bushels, nearly the half being grown in Russia. Little Denmark with her many cattle grows nearly six times as much barley as wheat. Its esteem as a forage plant is increasing so rapidly in the United States that the crop has doubled within fifteen years. Its recent growth in Kansas and for hog feed suggests its substitution for corn on the arid edge of the corn belt.

Its heavy yield causes the Japanese to use it on lands not suited to rice and the crop is more than one-third as great as the rice crop, and three or four times as great as the wheat crop.

5. BUCKWHEAT

Place of Growth and Use.—Buckwheat, an unimportant cereal, is among grains as the goat is among animals—conspicuous for its ability to nourish itself where the supply of nourishment is meager. This feeding habit of the plant, enabling it to live on the poorer and rougher lands, in combination with its very short period of growth, makes it the cereal best fitted for growth under the worst conditions. These characteristics also make it a soil exhauster. It grows so quickly that it can be sown in midsummer after other crops have failed, or have been harvested, and yet ripen before frost. Its qualities combine to make it a crop for farms of rough and mountainous localities, such as the upper part of the Appalachian Plateau in New York and Pennsylvania, parts of New England and Canada, the mountainous districts of France, the Alps, and Russia. The excellence of the buckwheat flour for making batter cakes makes it a favorite article of diet where buckwheat is known. Persons who keep bees for the large-scale production of honey sometimes grow buckwheat because of the large amount of honey in the flowers, thus getting a double harvest. New York and Pennsylvania produce three-fourths of the total crop of the United States, which amounts to about 3 per cent. of the wheat crop.

6. RICE

Rice Characteristics and Rice Climate.—Without rice the human race would be greatly handicapped for locally grown cereal food in the torrid zone and in some parts of the warm temperate

s a heavy summer rain, as along the Gulf
! States. In such a climate all the European
ey, rye, oats, and buckwheat—fail miserably,
ı its best, owing to the bad effects of the mois-
rould find difficulty in filling the gap because
keep these northern grains in a hot moist
is often experienced in shipping corn down
er and through the Gulf of Mexico to Europe,
ity causes the corn to heat and mold. It is
ıat these climates have rice, Asia's great gift
h thrives under wet summer conditions and
dryness of the kernels and a protecting husk,
ithout deterioration.
the regions with moist summers what wheat
ith a dry summer. The two plants do not
region unless, as is the case in a few districts
n, a crop of winter wheat can be harvested
ıg of summer rains, which furnish the proper

l **the Monsoon.**—In the summer season the
seasonal wind, a gigantic sea breeze, blows
ırm, moist Indian and Pacific oceans across
tween the upper Ganges Valley and latitude
ı. It gives to eastern and southern India,
am, and Cochin China, the Philippines, China,
d Japan a heavy warm mid-summer rain.
mer rain produced by the monsoon is one of
in the relation of man to the earth. South-
adjoining islands, the region of monsoon
he leading cereal, is the home of more than
ce. One of the important reasons why this
world holds so many of its people is because
te has rain at the season of greatest heat and
ı in the cooler period of least growth such as
winter rainfalls of California, Spain, Italy,
and Chile. The climate possesses first the
ompel people to work for the non-productive
and then rainfall enough to permit great
ıs great numbers.

Rice flourishes in the wet summer due to the moonsoon, and in these parts of southeastern Asia, where the moisture is sufficient to its satisfactory growth, rice is the mainstay of the population. It is said to be the main food supply of one-third of the human race, but the extent of its use has been somewhat exaggerated through our contact with Oriental people at sea coast points and the resultant generalizations from those observations coupled with our ignorance of inland districts, especially in China. The rice is the grain of the moist low plain, and contrary to the general opinion it is a luxury to millions of Chinese and Japanese who live on the cheaper and less desirable millet, European small grains, and other cereals not known in America.

These European and other grains are raised where rice is impossible of cultivation. Thus, in northwest India the valley of the Indus does not have much rain and is an important wheat grower, as are the central plateaus of India around Bombay and upper Bengal. In north central and northern China, also, rice does not thrive, and wheat is extensively grown. In colder or more arid localities comes barley, and in the region of Pekin and southern Manchuria, corn, while many districts of central and north China have millet as their chief cereal. Southern Korea depends much upon rice, while in the rougher and colder north they grow barley, rye and oats, millet, and some wheat, and the same practices prevail in Japan.

Wheat and barley are often grown on rice land in winter, and the two grain crops per year measure the intensity of production.

The Antiquity and Uses of Rice.—The use of rice in these old lands of the East goes back into the unknown past. Centuries ago rice spread from China and India to Egypt and north Africa, then in 1468 to Pisa in Europe, and in 1694 the governor of South Carolina succeeded in cultivating it in his garden and thus started the industry in this country. A little rice is grown throughout nearly all tropical America and on both coasts of equatorial Africa, but no people depends upon it so fully as do those of southern and eastern Asia, with whom its use often replaces that of wheat, potatoes, and, to some extent, meat also. Among the people of Europe and America, rice is used as an ordinary vegetable, as well as for pudding, and as a substitute for the potato in periods of shortage of that article of

›eping quality and convenience in transport
ed anywhere and it is consumed throughout
from Iceland and Greenland to Patagonia and
ıis fact in combination with its use in the
pics probably makes it the most widely used

ıake bread because it lacks the gluten which
ır to form a sticky dough and become light
bubbles that yeast makes in it. The Oriental
ı that form, or flavors it with a bit of meat or
l it; or uses curry, a hot seasoning preparation
arieties. With peas and beans rice furnishes
ourishment for hundreds of millions of people.
e widely grown by almost all Eastern peoples
l they are the substitute for meat, milk, and
, while the starch of rice is the substitute for
nd many puddings as well. The unpolished
Oriental is much more nutritious than the
ı which we of the West insist upon eating.
lishing it takes off the most nourishing part,
numerous cases in which appearance makes
›ct the really inferior article. The rice bran
ie food and is exported as far as Europe. The
many purposes, including fodder for animals
ıfacture of hats and shoes worn by Oriental

In Sparsely Peopled Eastern Lands.—The
.eties of rice due to the age-long cultivation
wo classes, known respectively as upland rice
Lowland rice must be grown under water,
rice is grown much like wheat or oats and is
:e population is sparse and land abundant.
ɔf the East Indies such as Sumatra, Borneo,
ula, or some parts of Burmah and Indo-China,
ıl jungle covers with its dense tangle every
except where man has fought it back, upland
ı shiftless manner such as commonly prevails
population uses abundant land.
ce field is wanted, the people of a valley will

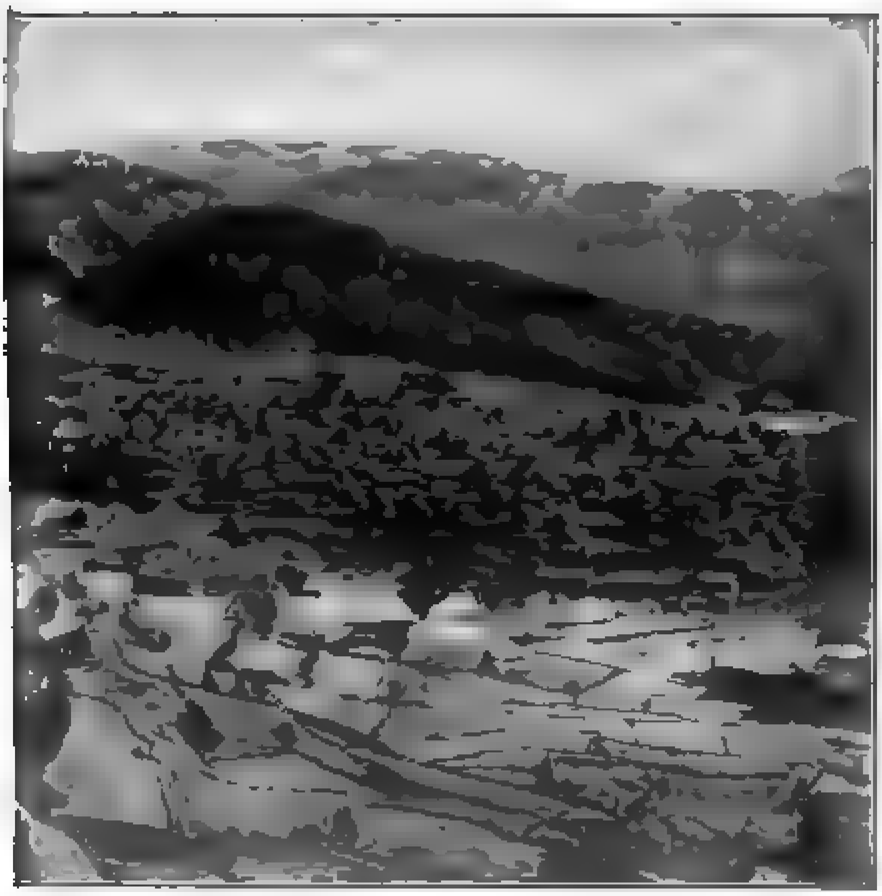
begin the year by cutting down the forest. Among stumps and prostrate logs, often higher than the worker's head, the upland rice is planted in holes made with a sharp stick and filled by the bare foot. As young rice is much prized by wild animals, from the elephant down to the small rodents, the clearing must be watched until the harvest. After two crops are taken, the field is abandoned for a fresh field and the tangled jungle promptly reclaims the land.

Rice Growing in Densely Peopled Lands.—Most of the countries with monsoon climates are too densely peopled to grow their rice in this crude way. In such localities the land once cleared is kept in cultivation for centuries. Dense populations nearly always grow the wet variety of rice, because of its greater and more certain yield. Few crops are surer than the wet rice, and few more uncertain than upland rice. Wet rice must be grown by irrigation, and the devices used in fitting and keeping the land for this service are among the greatest monuments of human diligence in the world. They are certainly the most creditable constructions produced by tropical peoples, the only rivals being the slave-built monuments of tyrants. In Ceylon, for example, the railway that goes from the seacoast to the highlands goes through an irrigated plain divided by low banks into ponds of small area,—rice fields, each of which has by great labor been leveled so that the water may be of uniform amd proper depth for rice growing. As the railroad climbs the slopes of the hills the rice patches continue, with smaller area and higher banks, turning at last into a giant flight of gentle water steps, one of the most beautiful landscapes that the world possesses. Many mountains in Java are similarly terraced for rice far up their sides; and, in China and Japan, similar stupendous works have been constructed for the support of the populations, which, like those of Java and of Ceylon, are very dense and mainly dependent upon agriculture in which rice is the largest staple. In Japan 56 per cent. of the arable land (11,000 square miles) is in these irrigated paddy fields.[1]

The common treatment of the lowland rice is alternately to flood it and draw off the water during the early periods of its growth. It is kept under water during a larger part of its

[1] King: *Farmers of Forty Centuries.*

water being entirely drawn off as it ripens. ot become stagnant, and to keep it in motion practice on the hillsides to lead a stream to nd let the water pass from terrace to terrace In many places, especially in China where is often inadequate, it is necessary to lift the lower terrace to the higher ones by ans. Sometimes where the water is abundant,



light emphasizes some of the many water terraces that illage upon the slope of the tropic mountains. Sagada nds. (U. S. Bureau Insular Affairs.)

is used. As it revolves, the bamboo buckets, nboo on its run, empty water in a trough when op of the wheel. It is an exceptional place ficient water to use this water-power method. China and India two men may be seen strad- that separates two terraces. With a bucket from the lower to the upper, where they pour so that it may not injure the little rice plants

The utilization of these terraced hillsides with the accompanying menace of an avalanche of water is as great a monument to the diligence and patient care of these peoples as is the construction of the terraces. Only constant vigilance prevents the breaking of the upper terraces, which, should they give way, would promptly discharge the water into the ones below, fill them to overflowing, and so, gathering force as it went down the hillside, the water would, like an avalanche, leave ruin behind it.

Amount and Kind of Labor in Growing and Preparing Rice.— The labor of rice growing often involves the raising of plants in small sprouting beds and transplanting them in little bunches to the rice field itself. This work, as most of the other work in connection with terrace-grown rice, can be done only by hand. The small fields make it impossible to use such machinery as reapers and at times even the ox. But beasts of burden are often unattainable in a densely populated country like China. There is not land enough to raise food for many animals, so the spade in the hand of a man replaces the plough drawn by a beast, and the garden replaces the field of more sparsely peopled lands. Parts of China and Japan and India have reached the ultimate stage of agriculture, where man grows by his own labor the food for his support, and there is small possibility for increase of food production. This omission of animals is by no means universally true for there are millions of water buffaloes plowing rice fields in the Philippines and the mainland of southeastern Asia; and India, peopled largely by people who eat no meat, has more cattle than the United States, but their chief purpose is to serve as beasts of burden.[1]

[1] We have here some of the conditions that enable us to appreciate the great differences in man's relation to the land in the east and the west, in the sparse and the densely peopled country. The American farmer grows corn and feeds it to cattle and then eats the cattle, but one ox eats as much as five men and requires five times as much land for his support, so the numerous Orientals often omit the animal-feeding stage and grow rice and vegetables and eat them rather than feeding them to animals. Great increase in population could result from the essentially vegetable diet and the omission of animal raising. The ox that consumes as much as five men lives at least two years and will not produce over 750 pounds of meat. It is reported that the excessive amount of 5 pounds of meat per day is allowed the Argentine cowboy. Thus an ox represents 150 days' rations for the Argentinian *vs.* 3,650 days' rations (ten years) for the Oriental—one of the many striking results produced by difference in density of population.

ic rice field is finally drained, the ripened by hand, tied up in bundles, and allowed to sh this in moist places, it is often necessary upon bamboo frames. It is usually threshed aid of some very simple hese is a board with a ig the rice through the is from the heads and into a receptacle. The is called paddy because sk not unlike that which nel. As with oats, these ain to keep much better isk is removed and the ways deferred until the iches. Among the Ori- usking of the paddy to l is a daily occurrence, hand. One of the com- oughout the East from and from the equator pounding of a heavy it falls into a vessel full process of pounding the g the husk.

—The enormous home e in China, Japan, Java, d most of India prevents om having a surplus of The chief surplus for ex- s market comes from the e Ganges in the Province lcutta, India, from the

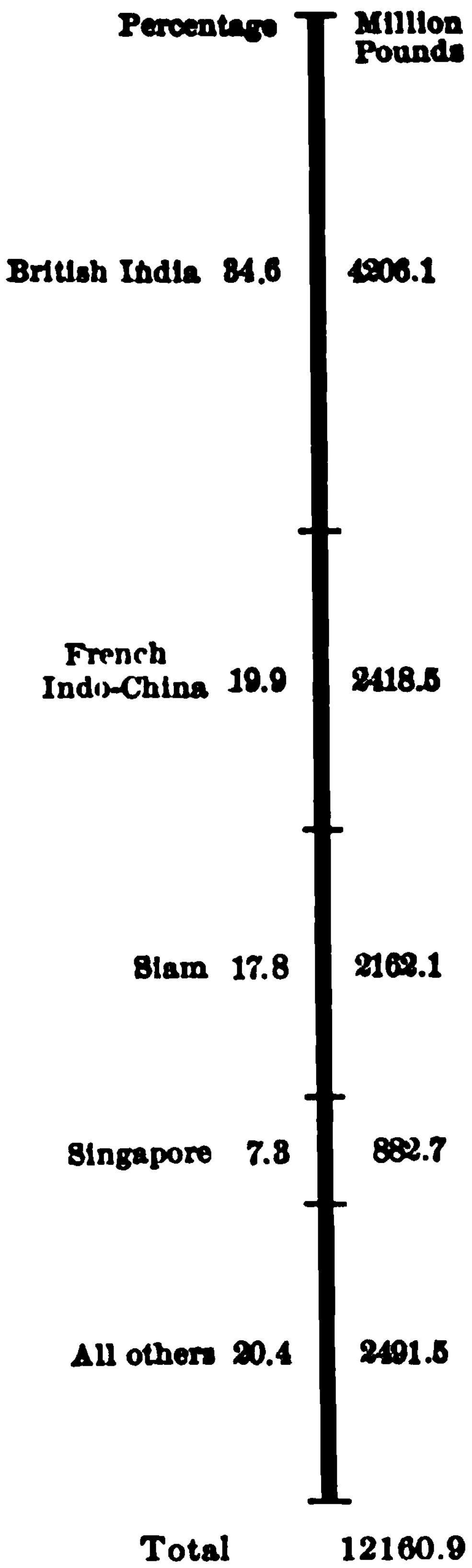


FIG. 35.—World's rice export, three-year average, 1908–10.

'addy River in Burmah, the Menam River in ekong River in French Indo China. These e, river-borne soil lie favorably for cultivation Burmah and Siam and Cochin China, these the larger part of the population of these e soil is so productive that large quantities of

rice are left as the money crop of the natives who grow it in these unwholesome swamps. This surplus they carry in their native boats down through the winding waterways to Bangkok, Rangoon, and Saigon. Here, in the mills of English, German, French, and Chinese firms, the paddy is cleaned in the wasteful fashion demanded by Caucasian consumers, by whom the part eaten is only half as nutritious as the part consigned to the animals that get the rice bran.

The Spread and Extent of Rice Growing.—It has come to the west late in history and thus far the development of rice growing outside the Orient has been slow and small. The annual overflow of the Nile due to seasonal rains in central Africa, and the easy irrigation, make rice as much at home as it is in the garden farms of Japan, the lower valley of the Yangtse Kiang, or the terraces of Ceylon and Java. Some rice is grown in Egypt, but not enough for the population, probably because of the European dominance of the Egyptian agriculture. Although rice is a standard article of diet in every country of America and Europe and of every European colony, these many lands are importers, with the possible exception of Peru, where the combination of Chinese immigrants and irrigation has caused a production over one-third as great (1910) as that of the United States.

Rice Growing by Asiatic Emigrants.—The spread of East Indian laborers to the Islands of Mauritius and Reunion in the Indian Ocean has introduced rice growing there, while similar people, lately taken to the British colonies of Jamaica, Trinidad, Honduras, and Guiana have carried with them the methods which their rice-growing ancestors have practised for a hundred generations. Of these tropic American rice fields British Guiana has the best. Here, although the country is mostly uninhabited forest, there are large stretches where the level, alluvial swamp along the seashore has been utilized by the building of dykes, after the manner employed in Holland. The reclaimed land greatly resembles the rice-growing deltas of the rivers of southern Asia, and, since the decline in profits of sugar growing, the East Indian workers of Guiana are growing greater and greater quantities of rice. Between 1898 and 1908 the acreage increased from 6,000 to 38,000, and the value of the output by 1 1/4 million dollars. The Guiana rice crop is, how-

o-fifths as great (1910) as that of Peru where
'ants started it a generation earlier.
;he facts of export cause unsound inferences
.ction. There is no necessary connection
A small population, and a production small
ther countries, permits countries like Argen-
appear large in wheat export, as French Indo-
in rice export, yet they produced respectively
ınds in 1909 in comparison to 16 billion in
lia. The rice crop of India covers four times
s the wheat crop. China, almost devoid of
even reliable population figures, is, with rice
ırticles, incapable of accurate comparison, but
nated at 50 to 60 billion pounds. (*Year-book*,
of Agriculture.) The total rice export of
13 billion pounds or 220 million bushels of 60
ıt smaller than the wheat export of Russia.
luction of the world, including China, seems
wheat crop of the world exclusive of China.
ı **Europe.**—Rice is of great value to dense
ıe of the high average yield. In Japan in
34 bushels to the acre, while wheat yielded 20
ıited States (1907–11) wheat made 14.5 and rice
e. Furthermore the farm price of rice is nearly
ıat. For these reasons the cultivation of rice
in southern Europe in most places where the
ıfficient for irrigation. In the Rhone Valley
:e is grown. In the Po Valley of Italy a third
equal in size to a typical American county,
in rice, and Italy, producing nearly as much
es, is the only country with Caucasian popu-
ıugh rice for her own use. Spain grows about
:h as Italy and Greece grows a little.
nd the Use of Rice Machinery in the United
: surprising success of the governor of South
a patch of rice in his garden in 1694, rice grow-
dustry in that colony and in Georgia, since
seacoast and rivers could readily be dyked off
negro slaves in the Oriental way. This was the

chief place in the whole thirteen colonies where negro slaves were profitable in 1787, and it was due to the influence of Georgia and Carolina rice growers that slavery received its recognition in the Constitution of the United States.

These two states have grown rice of excellent quality down to the present day, but they are now suffering from the competition of the newest and most interesting of all the world's rice fields, that upon plains near the Gulf coast not far from the boundary between Louisiana and Texas. Here are lands of wonderful levelness and with a very satisfactory clay subsoil to keep water from soaking through. By the building of dams, the digging of wells, and the erection of pumping plants, arrangements have been made for the mechanical supply of the irrigation water, after the ground has been ploughed and harrowed with teams and cultivators akin to those used in the preparation of large areas of wheat land. This is made possible by having the dykes of such gentle slope that teams can be driven across them. After the water has been drawn off at ripening time, the ground is firm enough and the area large enough to permit reaping machines to harvest the rice like wheat, and steam thrashers to throw off the chaff and straw into piles, and to fill the rice sacks as quickly as they fill wheat sacks. This conquest of the primeval Oriental hand-labor garden crop by American farm machinery has enabled one man to take care of eighty acres of rice in a year, and though he is paid twenty times as much as the Chinese laborer, he produces rice more cheaply because the Chinaman cares for only one or two acres by his arduous hand labor.

This new rice region grows many times as much rice now as the more expensively managed swamps along the South Atlantic Coast, and it is possible that before long the United States will become a rice exporter rather than, as now, an importer. But it will take a good many years for the American rice growers to get acquainted with their new industry and acclimated (if possible) in the necessarily damp climate which accompanies the irrigation of land upon the warm and moist shores of the Gulf of Mexico.

According to present estimates (U. S. Department of Agriculture, *Bulletin 47*) there are about 10,000,000 acres of land along the Gulf well suited to rice. Present methods could irrigate

ıis with surface and artesian waters. The
irrigated at greater expense. With a two-
f of the easily irrigable rice land, 1,500,000
each year and should supply 1,620 pounds
ıtely 2 1/2 billion pounds. This amount is
sent consumption, of which we now ordi-
per cent. In 1790 we exported about 25
pita and ate less than half a pound. Now
capita and export none.

MILLET AND SORGHUM

f necessity much difficulty in appreciating
ıillet as a cereal. It is a plant not unlike
general appearance, with its seed in a head
›f the cat tail. The grain, which is smaller
boiled and used like rice, or eaten parched
and porridge. There are many varieties,
ı height. Some are grown for forage only,
be used as human food, some for both pur-
furnish fuel in their woody stalks.
some extent in most parts of the temperate
tropics. It is grown occasionally in nearly
ed States for forage only, but the excellence
ıd south and alfalfa in the west keeps it from
e in this country. It has a similar use as
ing extensively grown in the Mediterranean
It is used as food to a slight extent in Europe
ves of Mexico and Africa, but it is in Asia
its greatest importance. It is estimated[1]
e human race use the seed as food. Japan
annual consumption of 35 million bushels.
vates 40 million acres, while her wheat crop
million acres and that of the United States
l). In China also there is very general use
d there are records of its use for about 5,000
ts of the Russo-Japanese War showed that
gns were waged in fields of millet and Indian

ıller: *The World's Commercial Products*, p. 59.

corn, which resemble each other very much as they stand in autumn shocked in the fields.[1] Millet seems to have been very important to the prehistoric lake dwellers of Switzerland.

The sorghum family is another cereal producer little known in the United States but important in many parts of the world. To this family belongs the well-known broom corn from which brooms are made, Kaffir corn, the sugar-producing sorghum (discussed on page 287), and many others entirely unknown in this country. They are tall plants with general resemblance to millet in appearance, excepting a difference in the form of seed-bearing head. In uses they are substitutes for both millet and corn. In China, India, and Africa their use as forage is very great and their use as human food is also very common, while some of the many varieties are cultivated for human food in nearly all the warmer countries of the world. A member of this family is dhurra, the oft-mentioned food grain of many African tribes.[2] Recently certain drought-resisting sorghums have sprung into prominence as forage plants in the drier parts of Kansas and Oklahoma where 1 1/4 million acres are already grown. (U. S. Department of Agriculture, *Farmers' Bulletin* 448.)

8. CORN OR MAIZE

The Value of Corn to the Settlers of America.—When the first American settlers landed in Massachusetts and Virginia, the Indians presented them with ears of this valuable grain which the settlers called Indian corn, corn being the English word for grain. The Spanish called it maize. The colonists, to their great benefit, at once began to cultivate it, because it was so much easier for them to grow than the wheat, barley, rye, and oats with which they had been acquainted at home. These small grains, grass-like in their early growth, require for their

[1] E. R. Scidmore in *National Geographic Magazine*, April, 1910, says that a giant millet 10 or 12 feet high, along with a short millet and sorgum, is extensively grown in Manchuria. The giant millet looks like corn shocks in Indiana and "is used for food, fuel, distilled drink, mats for the floor, and for building material, and has thousands of uses and the yield a thousand fold."

[2] A Reuters dispatch from Wad Menadi, Blue Nile, discusses the effect of rain on "durra, which forms the staple food of the native population."—U. S. Con. Rep., 1912, p. 310.

›n smooth land free from stumps and stones. n the woods did not have. But the Indian :ill the trees by cutting the bark, so that he lant corn among the standing trunks and, ltivation, have unripe corn ears for roasting much quicker return for his labor than wheat ·w. By September or October the settler ı that would stand a month or two awaiting ıarvest it. In this respect it was superior 'hich must be harvested at once, lest storms he corn, moreover, yielded twice as much as easily kept, and could be served as food in ched corn, made by heating the whole grain ver an open fire; as hominy, which is the ;hly boiled; as mush (samp), made by boiling , as cornbread. The husk that protected the mattress for the colonist's bed; the stalks ›rses and cows through the winter, even after months as a thatch for the temporary shed imals from storm.

rn in Rough Countries like Appalachia.— r of corn to grow on very rough land where not do so well, or yield so much, it has come ıe world to be the mainstay of primitive or where the climate permits. In the central ıu of east Kentucky, east Tennessee, and example, where many counties comprising uare miles are entirely devoid of railroads or ;he primitive conditions of the Revolutionary corn, both as food and a staple of commerce, tance.[1]

ts inferior corn crop furnishes a good example of the ınt on history. About the only way in which corn hese plateaus is by converting it into whisky or live ıct that the United States Government taxes whisky ıas been a century-long struggle between the collector cit distiller, the "moonshiner" as he is called, of the ıs. The mountaineer feels that it is a tyranny for x the only thing he can sell. This feeling took its hington's administration, when the people of western ıg to the tax, arose in insurrection against the new led "Whisky Rebellion."

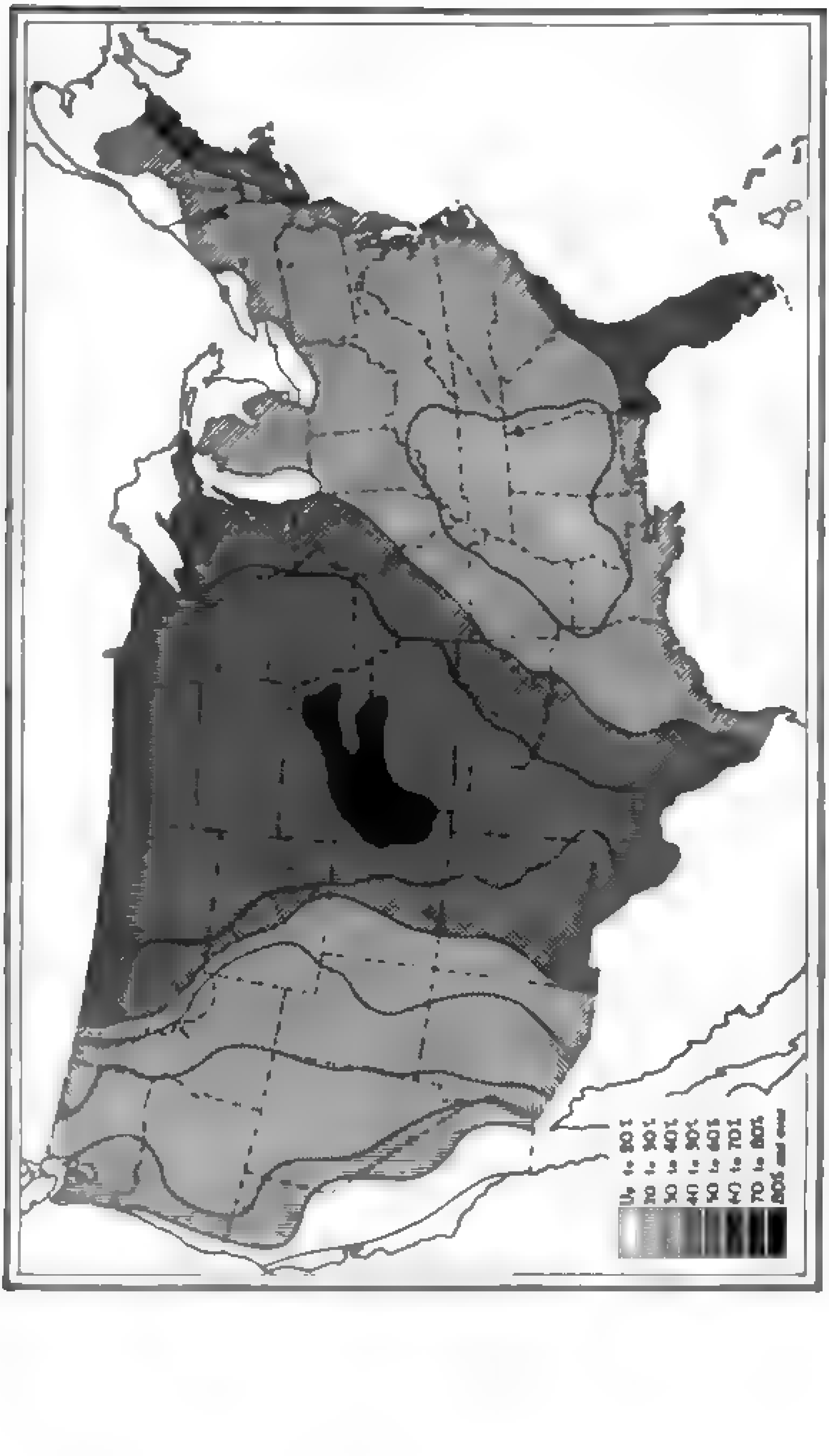


FIG. 36.—Map of United States showing the percentage of annual rainfall received in the six warmer months, April to September. (After Gannett, U. S. Geol. Surv.) (From W. S. Tower.) Summer rain is a great corn factor.

.—Corn will mature if there is a five-
and a hot midsummer with sufficient
wth of the plant, which at times amounts
nd in a few weeks to a height of from
re. Accordingly, regions with a cool
d, Scotland, Ireland, in fact all north
land north of latitude 44°, and Canada,
o, cannot well produce a crop of ripened
nent of the maize plant includes warm

tates showing average dates of last killing frost in
killing frost in autumn (solid lines). (After U. S.
. S. Tower.)

days, so that many arid regions having
nights, such as Nevada, are not suited to
on of corn despite an apparently satis-
ature.
eat, it does not do its best in the continu-
or even in the prolonged summer at the
pi River. It seems to require a climatic
ial spur furnished by the gardener who
perous tree to make it pause in its growth
it. The cooler weather of approaching

autumn seems to be an essential to fully turn the energies of the plant from leaf production to seed production. For this cause apparently the yield of grain is larger in the latitude of the central temperate zone than in its warmer parts or in the tropics, under conditions otherwise much alike during the growing season. For a ten-year period the average production of Louisiana corn was 16.3 bushels per acre, while Wisconsin had 33.2 bushels per acre.[1]

FIG. 38.—Average dates of the beginning of planting corn. (U. S. Crop Reporter, U. S. Dept. Agr.)

The cultivation of corn is, however, widely scattered throughout the warmer parts of the world between 45° north latitude and 40° south latitude.

The chief regions of production may be divided into seven zones: the upper Mississippi Valley, the United States cotton

[1] Like influences work even greater effects on other plants. Some vegetables of the beet family produce nothing but leafy tops in the continuously warm West Indies, although the nourishment stored in their thick roots for the next year's seed growth makes them an essential part of agriculture in Canada, Sweden, Germany, and other lands of frost and cool summers.

ı, including Mexico, the Black Sea basin, the ıtries, southeastern Asia, and the Parana erica.

rn Belt.—Of these the first and most impor- important than all the others combined, is Mississippi Valley. Corn is grown from the ıe Great Lakes, and from the Atlantic Ocean nd in scattered areas beyond, but the region on, the so-called American corn belt, reaches to central Kansas, and from Kentucky to ıdes all the state of Iowa, nearly all of the Illinois and Indiana, Ohio, and about half of ka. This region is one of the finest agricul- e entire world. Hundreds of miles of almost rely varied by undulations steep enough to ıying out of roads on meridians and parallels of one mile. This soil that lies so beautifully ılly fertile, and so free from stones that the e cultivator with which he tends the corn. vators till both sides of one row of corn, and ı take two rows of corn at once. Thus, an ı cultivate a large area of corn, sometimes es, and produce the grain that was so wonder- ıny years. Serious droughts are infrequent The abundant rainfall of summer comes in h do not seriously interfere with agricultural e heat is sufficient to make a most excellent

ı to Other Products of Corn Belt.—Corn is ı the corn belt. On a single farm there will be, ı, fields of oats and hay which require the ifferent seasons from the corn; also there will ıpon which cattle can graze.

ıall portion of the corn belt grain goes directly ı the parts of the corn belt most distant from as Iowa and Kansas, the major part of the supply crop, is fed to the farm animals and ı the more condensed forms of beef, pork, ıd mules. Near the great markets where the

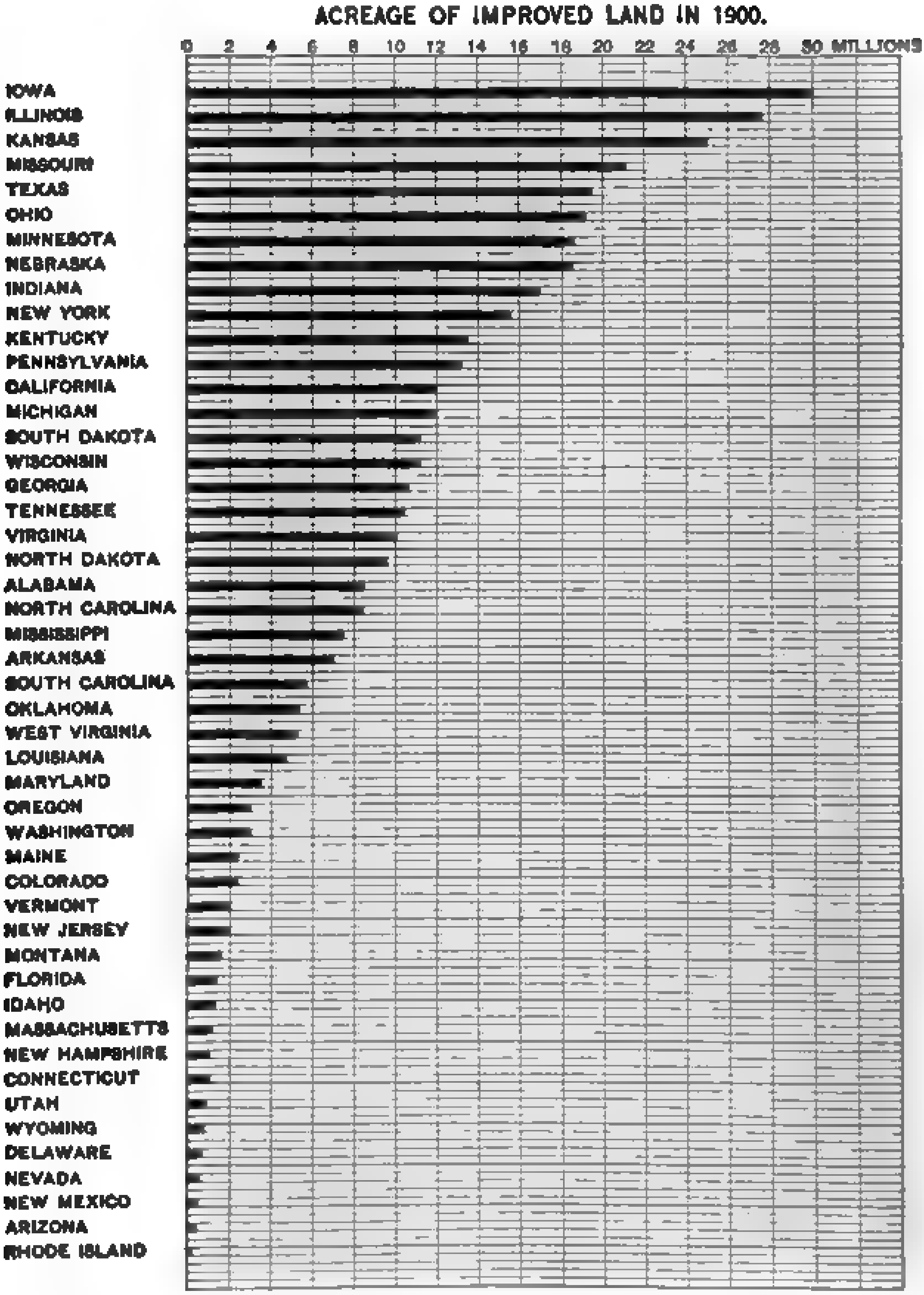


FIG. 39.—Proof of the excellence of the upper Mississippi Valley for agriculture. (From Report of U. S. Conservation Commission.)

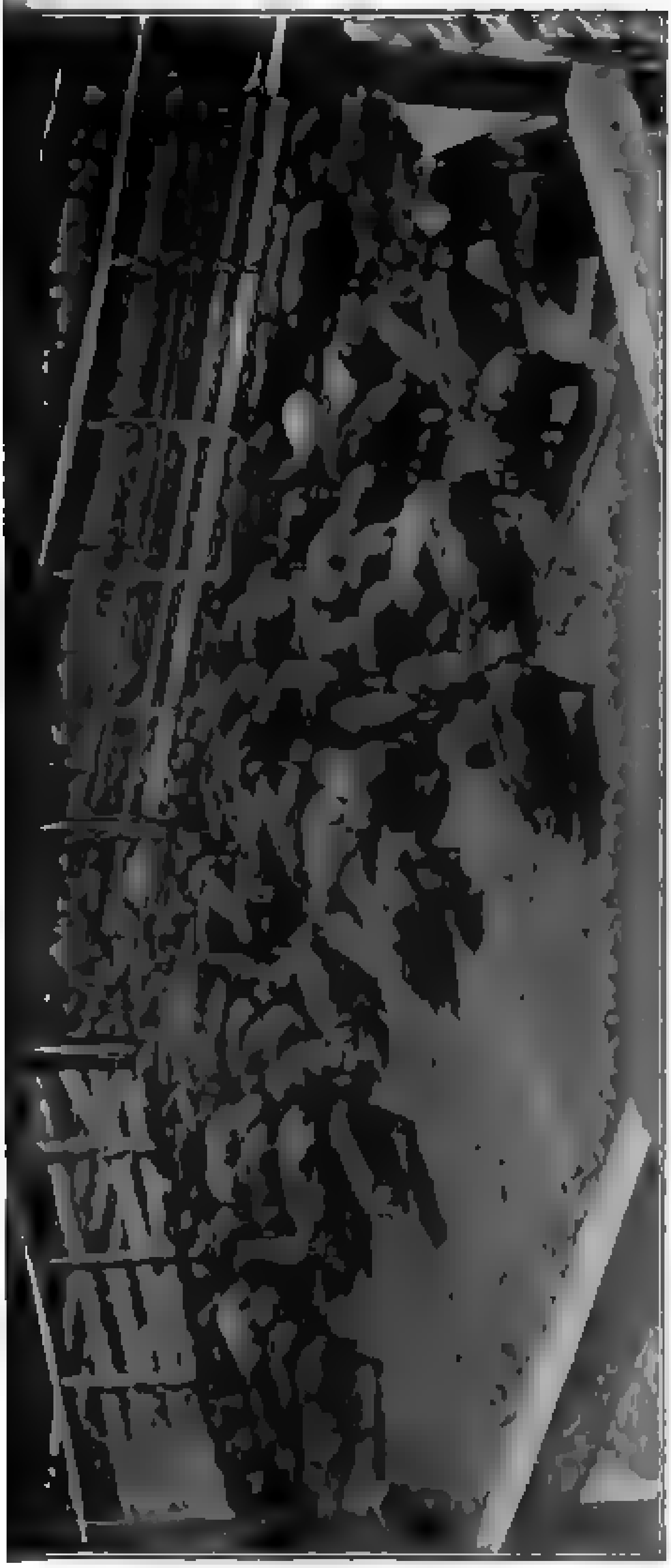


FIG. 40.—Farm corn field and corn condensers, 140 hogs fed on corn and molasses feed, gained 1 2/3 lbs. each per day for 100 days. (Champion Feed Milling Co., Lyons, Ia.)

transportation is cheaper, as in Illinois, the proportion of grain sent directly to market is much greater. In 1910, 48 per cent of the corn of Illinois was shipped out of the county where it was produced. In Kansas the corresponding figure was 22 per cent, in Texas, yet farther from markets, it was 7 per cent.

The Improvement and Extension of Corn Growing.—Great improvement in corn growing takes place from year to year as the scientific agriculturalists breed new and better varieties and select the seed to take advantage of the known laws of heredity.

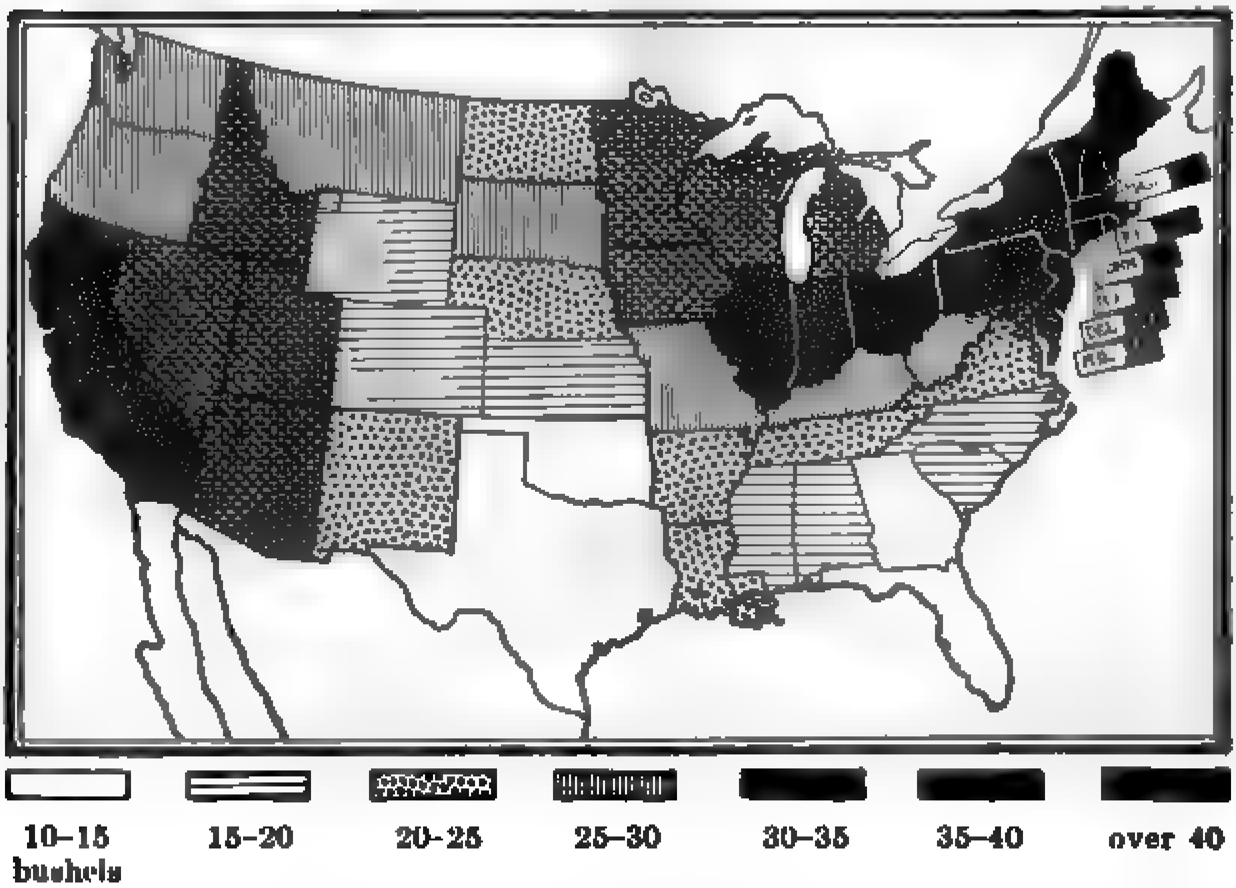
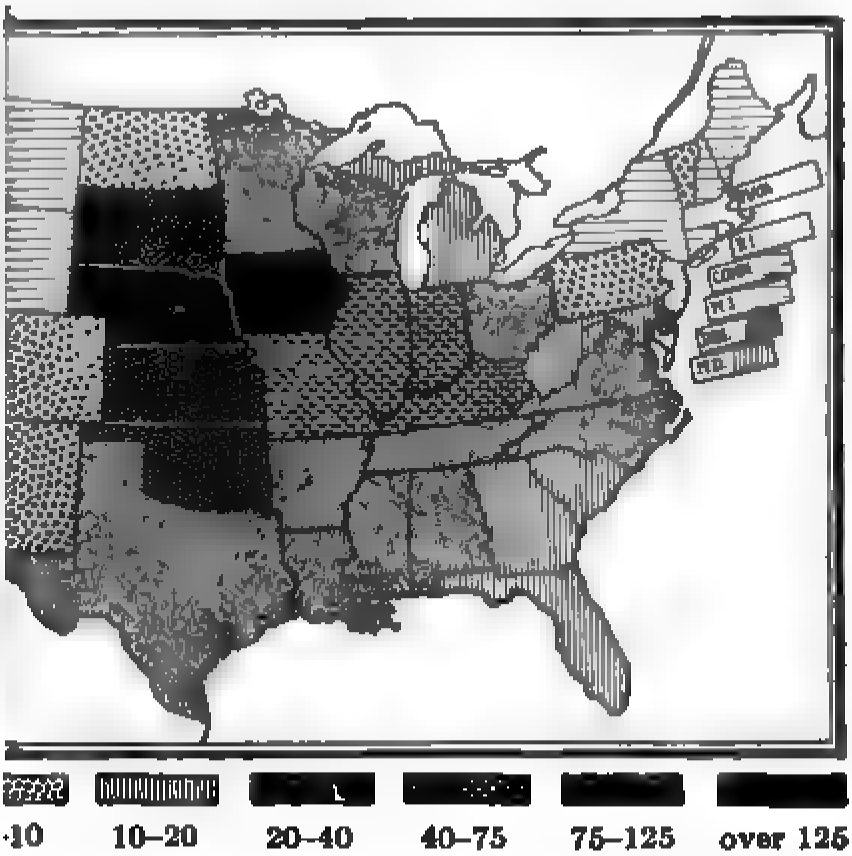


FIG. 41.—United States corn production in bushels per acre by states, three-year average, 1909–11. Pop. 1910.

In a recent corn test[1] in Illinois one large field yielded 48 bushels to the acre and a similar adjacent field yielded 77 bushels to the acre, and the only element of difference was in the superior well-selected seed that produced the larger crop. The breeding of earlier ripening kinds will doubtless make possible a greater growth of corn in those parts of the northern United States and Canada, where it is not now a dependable crop. At present it is grown in Canada only near the Great Lakes and in much of the northern part of the United States is of little importance.

[1] J. R. Steward: Proceedings American Breeders Association, Omaha meeting, 1909.

nding the area and value of corn production, climates, is offered by the silo. This device, from France, is a barrel-like structure, 10 eter, made of wood or concrete. Its use is ease because the entire plant, stalk, leaf, chopped into bits, may be kept moist, warm, le for one or two years. In this form, called its greatest possible food return to ruminant sed in the feeding of dairy and beef cattle, be put away some weeks before it is fully



corn production per capita by states, three-year average, 1909–11. Pop. 1910.

own much farther north than can the ripened kept only after fully maturing in the field. nmer of New England, the silo helps in a al combination. While corn may not ripen, ets ready for table use—the so-called roasting- rom a field of sugar corn wagon loads of ears ing factory or the vegetable market and the the farmer's silo to feed his dairy cattle— in systematic agriculture. Further than rn of the north is in some markets recog-

nized as of superior quality because the cold climate delays ripening, gives a longer period in the edible milky condition, and thus gives better opportunity to harvest it in its best edible form.

Corn in the Cotton Belt.—Corn is the second crop in importance in the cotton lands of the South, but cotton is so overwhelmingly the main crop that the corn crop is often insufficient for local use, and import from the corn belt is necessary. Corn, but little used as human food in the northern half of the United States, is in common use in the southern states and is often the chief breadstuff of white and black alike. Its excellence for the support of human beings is unquestioned by physiologists and it was well shown by the endurance of regiments of soldiers in the Confederate armies during the American Civil War. Nevertheless, corn is generally unappreciated as food outside of the southern states, except in regions where the people are poor, as in Italy, Roumania, Hungary, Mexico, etc., where it is used because cheaper than the other breadstuffs. Two shortcomings suffice to explain its small use: it has no gluten and will not make a dough, or light bread; second, the bread loses much of its palatability upon getting cold. Cornmeal gruel or mush called "Polenta" is a staple article of diet for large numbers of Italians.

American Corn Exports.—America has often exported a hundred million bushels of corn annually, and sometimes double that amount to northwestern Europe where it is fed to farm animals and work horses. It is almost always sent from the region of heaviest production in our corn belt, first being assembled in the markets of St. Louis, Kansas City, Omaha, or Chicago. From these points it passes by lake steamers and the Erie Canal or by railroads to the Atlantic ports between Norfolk and Montreal for export by the North Atlantic steamships. A smaller amount goes to Gulf ports, but they are not desirable for corn export.

At various times exporters of corn from the United States have attempted to spread the habit of corn eating among the peoples of northern Europe, but without success. This is due chiefly to the conservatism of all peoples toward changing their diet, and partly because of the above-mentioned limitations of corn as a breadstuff.

n export has declined of late from 195 million .896–99 to 50 million bushels 1910–11. This ilure, for the average crop in the first period ushels and in the later period it was 2,719 ith an increasing popu- ær capita consumption ıshels in the first period later period. As we ıds to turn to and some e declining in produc- ave reached the end of n. When Kansas corn) to $25 an acre there to be had; it was at coal and was burned uel in the family stove. ıo corn frontiers since is rising. It was about the Chicago market in ater it was sixty-seven nce upon the European · the decrease in our ex- cade from 213 to 38 he lessened corn export up the price of other cing world wide price ustrial adjustments.

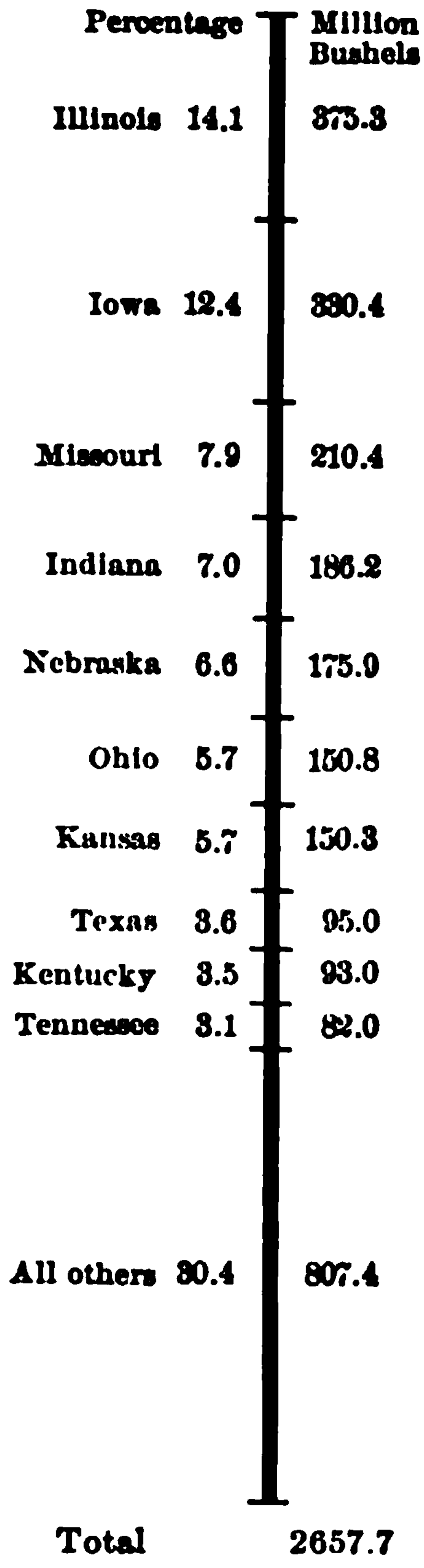


Fig. 43.—United States Corn production, three-year average, 1909–11.

America and Mexico.— an highlands, reaching of the United States to the third corn-growing ported from these coun- raised for stock, since e year round. In every one of them—Mex- al American countries, Columbia, Ecuador, he bulk of the population, native Indians or lerive their nourishment to a surprising degree ıs. Many of these Indians and half-breeds, ve a very low standard of living. The sim-

plest shelter suffices and rather than work much, they content themselves with beans, one of the most easily grown of vegetables, and corn, the cereal which they can most easily and cheaply grow. In Mexico and other of these countries the commonest form of corn bread is the "tortilla" or hot corn cake which can be baked over an open fire.

In these countries the population is chiefly on the plateaus, where the topography is often broken. The corn fields are usually small, and the production, which is almost always for local consumption, resembles the family garden rather than the broad fields of the American corn belt. Some of these plateau patches are of great fertility. It is said that there are certain fields in Ecuador where the soil, made of dust blown from the volcanos Chimborazo and Cotopaxi, has yielded crops of corn continuously for 200 years. There is no prospect that corn will ever be grown for export from these countries. The development of their resources will follow other lines. All Mexico north of San Luis Potosi is steadily importing more and more corn as its mineral resources and railroads give employment to workers.

Among the negro population of the West Indian Islands, corn is widely used for food, but not enough is grown for home use, and here, as is sometimes the case in Yucatan, there is a relatively large import of corn and cornmeal from the United States.

The Corn Region of the Black Sea Basin.—The corn zone second in importance to the United States corn belt is that of the lower Danube Valley and adjacent districts of the Black Sea basin in southeastern Europe. The crop of this region is from 350 to 400 million bushels a year, about one-tenth of the world's supply, and about equal to the crop of Illinois, our leading corn state. Although occupied by several different nations, the lower Danube Valley is, like our corn belt, one economic region. Corn is extensively grown on the great fertile plains of Hungary, Roumania, Servia, Bulgaria, and the nearby territory of Russia on the Black Sea. Further to the eastward the climate becomes too dry and in the Volga basin near the Caspian Sea the aridity is too great for tilled crops. The greater part of Russia and the regions to the north of the Danube Valley and to the west of Hungary are too cold for corn growing. There is also some corn grown in the more hilly part of the Danube drainage basin on the

. Mountains in Servia and Bulgaria. Austro-
about as much corn as Indiana; Roumania
: Oklahoma, and Russia somewhat less than
he bulk of the population in this corn region
they depend for breadstuff almost entirely
y export to western Europe the wheat which
ley also export some corn to western Europe.
land in Roumania one-third is in wheat, over
th of the total area) is in corn, as compared
ne-fourth of the total area of Illinois that is
The Black Sea basin is a land where droughts
easing frequency as one goes eastward. The
gion as a corn producer is shown by a com-
ield in bushels per acre in Roumania and
year period:

1904	1905	1906	1907	1908	1909	1910
4	12	25	12.5	15	13.4	21.2
39.8	36.1	36	31.6	35.9	40	39.2

spurs to labor is the certainty of reward, and
reward is one of the greatest deterrants to
lation between labor and harvest in Illinois
rtainty in Roumania, as shown by these fig-
corn yield, help to explain why one region is
ve and aggressive farmers and townsmen and
ıer backward peasants using oxen for work
these handicaps Roumania, by exporting
op, managed to send to the foreign markets
about one-third as much corn as the United
.anian corn belt is more accessible to water
to market than is that of the United States.
early twice as much corn as Roumania (187
.0), but consumes nearly all of it within her

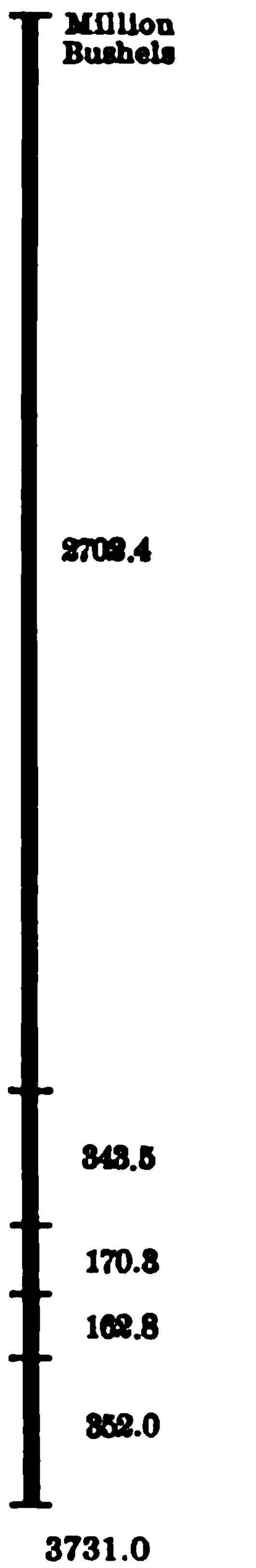
Corn Production in Mediterranean and Adjacent Regions.—Most of the Mediterranean basin is too dry in summer for the growth of corn except under conditions of irrigation. The large yield of corn per acre, however, makes it greatly desired as crop by peoples poor enough to use it as their chief food. Italy with 100 million bushels a year (about equal to Kentucky) is the leader, producing twice as much as Spain and the south of France combined. Wherever corn can be irrigated it is grown for home use, largely as human food, in Turkey, Greece, and Egypt where it is an important crop; but the dense population consumes all of the 100 million bushels of corn and wheat produced along the lower Nile, and in addition imports some of both grains. Certain plains in Portugal and western Spain near the ocean have rainfall sufficient for the satisfactory growth of corn without irrigation, and the crop of Portugal about equals that of Maryland and Delaware.

The desert heart of the Old World and regions adjacent to it reaching from southern Morocco across north Africa, Arabia, Persia, the deserts of central Asia and Gobi to the great wall of China, can, as in Egypt, produce corn only where irrigation can be practised. The people of the Barbary states grow some corn, as do those of Palestine and Asia Minor. It is grown to some extent in Persia, and it is relatively important in Bokhara and other oases of Russian central Asia and Turkestan. In all of these regions it is prized as human food.

The Corn Belt of Southeastern Asia.—The sixth corn zone is to be found in the moist countries of southeastern Asia. In the drier parts of the monsoon countries, especially China and India, there are districts that suit corn quite as well or better than they suit rice. There the American grain is largely grown but not for export. How much is grown in these countries it is impossible to state, but vast quantities are used by the 700 million people inhabiting these countries. It is extensively grown in the part of China adjacent to Pekin and in southern Manchuria. Some of the battles of the Japanese-Russian War were fought in fields of standing corn.

The Parana Valley.—The seventh and last corn zone is the Parana Valley of South America. The lower part of this valley is similar to the lower Mississippi Valley in latitude and climate.

the edge of the tropics, considerable corn is e. Further down the valley in the cooler l provinces of the Argentine Republic and a uay where corn is of increasing importance. ntly been taken up, and, while the methods



'n production, , 1908–10.

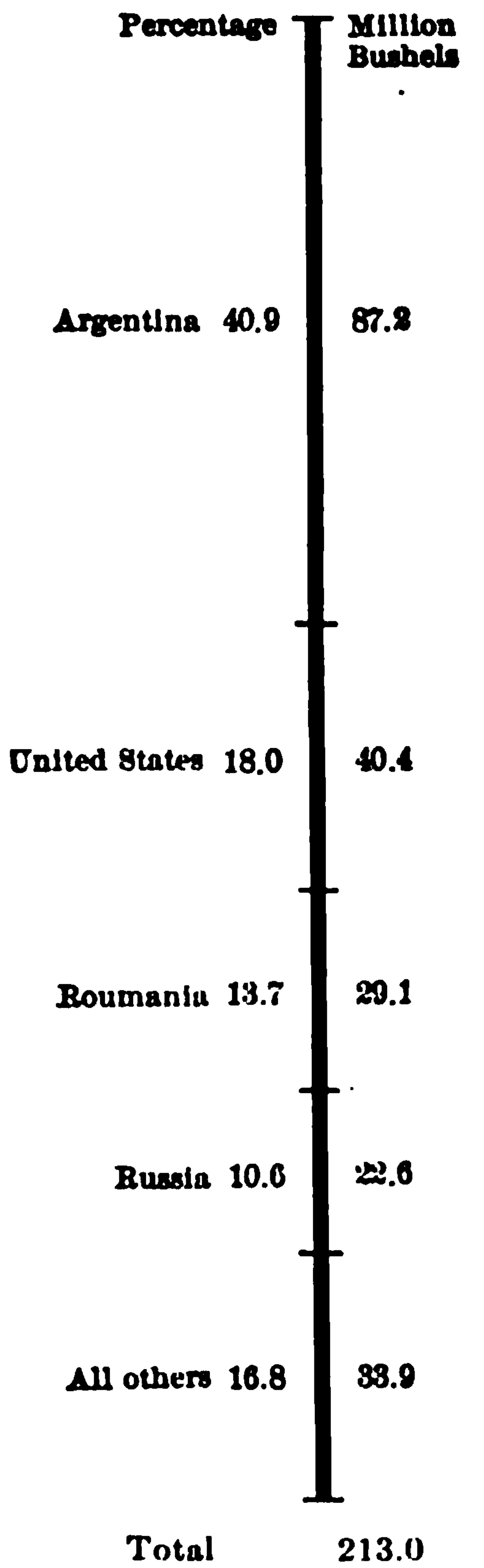


FIG. 45.—World's corn exports, three-year average, 1908–10.

lingly careless, the soil is exceptionally fertile, iving more and more attention from the large farmers who have settled in that country. it the present time a larger proportion of its y other country of the world, because the imerous as those of Illinois, do not yet use it

largely as food, and for the fattening of live stock alfalfa generally suffices. During the four-year period 1907 to 1910 the Argentine Republic exported 77 million bushels per year or almost exactly one-half her crop, while the American export of 52 million per year was a little over one-fiftieth of the total crop. The possibilities for the relative increase of corn production are probably better in the Parana Valley than in any other corn zone, because of the sparse population and large area, of which only a tenth is yet in cultivation. The present production is about equal to that of the Mediterranean countries. As compared with the United States there is, however, a disadvantage in the less regular rainfall, which will be a permanent hindrance to great production because of the uncertainties of the harvest. Thus the fine crop of 1906, 195 million bushels, and nearly 30 bushels to the acre, led to enlarged plantings the next year, but the crop fell to 72 million and the yield to 13 bushels per acre. The area planted in 1908 fell back to that of 1906.

There are a few scattered places where corn is grown to some extent, as in northern New Zealand, and in the eastern margin of Australia, but here it has to battle against droughts and scanty rainfall and is unimportant. The same is true in South Africa. The grain may be grown almost anywhere through the torrid zone and is grown in many scattered places in Africa. This continent may some time have European management for its industries and become a large corn grower. It is true, nevertheless, that corn does better in the temperate zone with its chilly nights toward the end of summer than it does in the unmitigated heat of the tropic lowland.

Corn must, however, have hot nights for a part of its growth and the cool night of arid climates bars it from many irrigated districts in western United States. This fact, in common with the dry summer of the Pacific coast, causes corn to be of almost no importance west of the Rocky Mountains.

The present predominance of the United States in the world's corn production (exclusive of Asia) is well shown by the fact that the crop of 1911 (2,531 million bushels) was 81 per cent as large as the world crop of the preceding year and 63 per cent as large as the largest world crop ever before reported, 4,026 million bushels in 1910.

TABLE OF FOOD VALUES

from U. S. Department of Agriculture)

Refuse	Water, per cent	Protein, per cent	Fat, per cent	Carbohydrates per cent	Fuel value per pound, calories
	35.3	9.2	1.3	53.1	1,200
	12.0	11.4	1.0	75.1	1,685
	12.0	14.0	1.9	71.2	1,640
	12.9	6.8	0.9	78.7	1,620
	12.5	9.2	1.9	75.4	1,635
	12.3	8.0	0.3	79.0	1,620
	12.6	22.5	1.8	59.6	1,520
	68.9	6.9	2.5	19.6	555
20.0	62.6	1.8	0.1	14.7	295
20.0	55.2	1.4	0.6	21.9	440
35.0	48.9	0.8	0.4	14.3	260
25.0	63.3	0.3	0.3	10.8	190
45.0	2.7	11.5	30.2	9.5	1,515
16.0	37.8	5.2	4.5	35.4	915
48.8	7.2	2.9	25.9	14.3	1,295
24.5	6.9	19.5	29.1	18.5	1,775
	5.9	12.9	48.7	30.3	2,625
10.0	13.8	1.9	2.5	70.6	1,275

TABLE OF FOOD VALUES.—*Continued*

	Refuse	Water, per cent.	Protein, per cent.	Fat, per cent.	Carbohydrates per cent.	Fuel value per pound, calories
Sirloin steak	12.8	54.0	1.65	16.1		975
Neck of beef	27.6	45.9	14.5	11.9		1,165
Cod, salt	24.9	40.2	16.0	0.4		325
Salmon (canned)		63.5	21.8	12.1		915
Eggs: Hens' eggs	11.2	65.5	13.1	9.3		635
Whole milk		87.0	3.3	4.0	5.0	310
Cheese full cream		34.2	25.9	33.7	2.4	1,885
Butter		11.00	1.0	85.0		3,410
Oleomargarine		9.5	1.2	83.0		3,525
Unrefined lard		4.8	2.2	94.0		4,010
Pure olive oil, Pure coconut oil, Pure peanut oil, Pure cottonseed oil				100.00		4,040

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CHAPTER IV

STARCH FOODS

Two Chief Food Elements.—Starch, one of the two most universal food elements of all mankind, is classed as a carbohydrate—an energy food. It helps to make fat and heat to keep the body warm and gives energy for work. Starch is really the surplus nutrition which the plants store within themselves for future needs or for their offspring. Sometimes it is packed in the seeds, as in the grains; or the roots, as in sweet potatoes; or in the peculiar underground stem, as in the white potatoes; or even in the trunks of some of the trees, as in the sago palm. The other great food element is proteid, furnished by milk, meat, cheese, eggs, most of the nuts, and the leguminous plants, of which peas and beans are the best and commonest examples. Proteid, the tissue or muscle-maker, is contained to some extent in all the grains from wheat, the richest in proteid, to rice the poorest, so that the grains, by containing both the great food principles, are almost perfect food. As rice is the richest in starch, there is less need for the production of other starch-producing plants by rice-using peoples.

I. POTATO

Distribution and Use.—The potato is probably exceeded only by bread in the number of times per year it is eaten by the average European or American. The plant is a native of America, growing wild on Mexican, Bolivian and Peruvian plateaus, whence it was taken to Spain, to Italy and to Vienna. From Vienna (1598) it spread rapidly through Germany. Introduced into Ireland in 1586 by Sir Walter Raleigh, it soon became important. By 1760 potato growing was general in Scotland, and its growth to some extent is common in all Caucasian lands. It appears occasionally even in Africa, but was not introduced into China till about 1875. In the rice-growing parts of this empire the potato is held

in the mountainous and northern parts it is
nd with much pride. The potato has certainly
as the great cool climate starch food. It is
nt most commonly grown in the vegetable
and America; but its growth as a money crop
offering in this respect a marked contrast to
to and rice are rivals in the supplying of starch
Europe and America, but the two plants are
ants for the same farmer's attention. The
l art of making potato flour has given the other-
ber a new means of competing with rice, but
has not met with very wide use outside of
was first manufactured.

f a Potato Country.—The potato is a crop of
e. A few hundred bushels are annually grown
n the Klondike on the Upper Yukon, and it is
the sub-tropic, as in Florida and Egypt. It also
of soils. It grows well on land that does well
out tends to become important as a main starch
id a money crop for farmers in regions where
rn to grow to the best advantage, or where the
nd light for the large yields of small grains. It
heavy clay. The regions that meet the potato
thern and northeastern United States, Canada
. North of the Alps the potato is exceedingly
region combines coolness with much sandy soil.
the dry summer of the Mediterranean climate
tion. Thus Sweden, with 5 1/2 million people,
otatoes as Italy, with 35 million people. In
pe, as in America, it does not compete much with
ith its hot summer being a great corn grower,
sister state in the dual empire of Austria-Hun-
otato grower. Austria alone, with its summer
d corn crop, produces from 30 to 70 per cent
n the United States.

p comparisons for 1909 shows many interesting
's relation to the earth which supports him—
great per capita growth of potatoes, barley and
rope where corn is not grown; and the small

CROP COMPARISONS FOR 1909

	Pop. mil.	Pop. per sq. mi.	Potatoes		Wheat		Barley		Rye		Corn		Oats	
			Acreage 1,000	Crop mil. bu.	Acreage 1,000	Crop mil. bu.	Acreage 1,000	Crop mil. bu.	Acreage 1,000	Crop mil. bu.	Acreage 1,000	Crop mil. bu.	Acreage 1,000	Crop mil. bu.
United States	87	29	3,525	376	46,723	737.2	7,011	170	2,006	32.2	101,778	2,772.3	33,204	1,007.3
Germany......	62	301	8,101	1,716	4,525	138	4,068	160.5	15,149	446.7	....	....	10,650	628.7
Russia.........	125	65	....	1,173	57,010	711.5	26,003	464.7	69,590	877.2	....	....	41,540	1,067.7
France.........	39	190	2,759	613	16,299	356.2	1,814	46.1	3,031	54.9	1.226	26.1	9,702	331.2
U. Kingdom ..	44	367	1,162	257	1,867	65.2	1,827	71.1	63	2	....	....	4,017	184.4
Belgium......	7	650	3[illegible]3	83	377	15.5	88	5	638	22	....	....	630	40
Sweden.......	5	31	340	62	222	7.0	477	13.9	998	25.7	....	....	1,994	75
Austria.......	26	226	3,087	479	2,998	585	2,795	79.4	5,134	114.4	845	16.1	4,574	171.9
Hungary......	15	152	1,580	183	8,728	113.3	2,857	71.9	2,485	44.8	5,831	161.8	2,695	92.2
Italy.........	34	309	....	60	11,635	190	617	10.9	300	5	4,445	99.3	1,200	43.4
World crop..............				5,523		3,632.7		1,475.2		1,744		3,523.8		4,317.2

hree northern crops in southeastern Europe,
ınd the United States where corn is more at
s for Austria (in the Baltic basin) and Hungary
basin) offer strong contrast of northern and
s. The table of United States potato pro-
hows these same facts quite as sharply in the
f this country.

: yields five times as many bushels per acre as
ıerefore it is of great value in enabling land to
ulations, although a bushel of potatoes is not so
ıel of grain. (See table of food values, p. 99.) A
ield per acre in the United States is for wheat,
, 26 bushels; potatoes, 92 bushels. Owing to
thod of preparing the seed, the expensive
y, the continuous cultivation, and protection
potato crop requires more labor than any of
e potato fields are smaller than grain fields, and
ted to intensive agriculture where a small area
bor, be made to yield a large product, such as
ountries of dense populations. The potato
e end of summer, leaves the ground in excellent
e crop of winter grain which usually follows it.
sponds well to intensive cultivation, the average
being 200 bushels per acre for the ten years
ın double the yield in America.

ıto Is Most Grown.—Ireland, a country of few
l moist climate, probably has a greater depend-
ato as a crop for the farm and food for people
ıntry in Europe. So great was this dependence
ilure of the potato crop, due to a blight, was
ıe from which thousands of people died. Scot-
ultural resources like those of Ireland, but
ger, also has potatoes as an important crop.
th Europe, reaching from the northwest point
gh Holland and Belgium and Russia to the
has in many places a sandy soil, and is the
est potato-growing region in the world. The
ant to the French, their crop of 600 million
being nearly twice that of the United States.

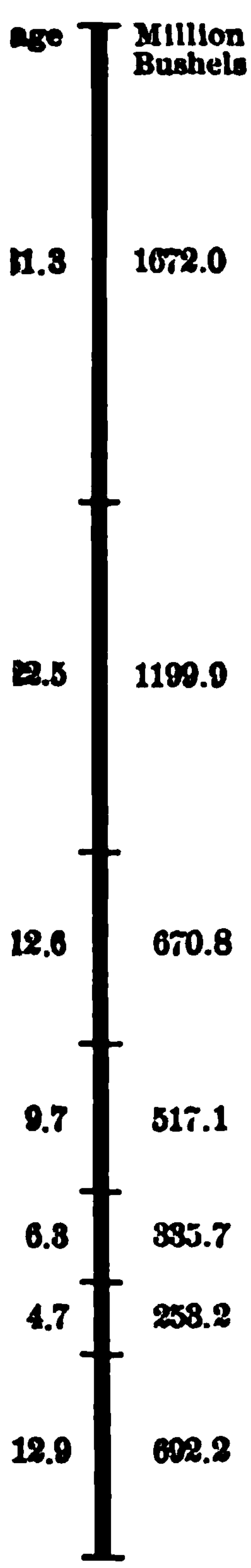
The uncertainty of potato yield is well shown by the French crop of 1910, 313 bushels, less than that of the United States. The Dutch and Belgians make their small countries produce a surprising amount of potatoes. The production in Belgium is about sixty times as great per square mile as it is in the United States, the population being about twenty times as great per square mile. North Germany with her cool sandy plains finds the potato one of the best crops she can grow; accordingly the German Empire is the greatest potato-producing country in the world.[1] Along with Holland, Belgium and the north of France, Germany has some potatoes to export to England, where the home supply is insufficient, although 2,000 square miles are annually devoted to this crop and the area is increasing, although her potato area is already over one-third as great as that of the United States and her output per capita is greater. Russia and the three Scandinavian countries with their cold climate and areas of sandy soils are relatively heavy growers and consumers of the potato. Even Switzerland grows nearly 50 million bushels a year and usually supplies her own needs, despite the fact that her 16,000 square miles of area are encumbered by the stupendous Alps and she has 3,600,000 people to feed—another evidence of the value of the potato in intensive agriculture. Switzerland even suffers at times from overproduction of potatoes.

In Germany, with her lack of oil and her high chemical skill, a particularly large flavorless potato unsuitable for food but yielding very abundantly, is grown to the extent of about 60 million bushels a year, for the sole purpose of being distilled into alcohol for fuel or drinking purposes. The same practice also prevails, but to a lesser extent, in Holland and Belgium. After making allowance for distillation and export, Germany has 20 bushels of potatoes per capita per year; Belgium, 11; Sweden, 12; Austria, 17, in comparison to 4 in the United States; and 2 in Italy and Chile (a South American country with the

[1] The stupendous potato crop of Germany, which, after all, covers but little more ground than Maryland, gives cause for the interesting statement of Professor S. N. Patten that it was the potato that enabled Germany in the nineteenth century to overthrow France, long her superior, in the days when wheat was a more exclusive basis of man's support than it was after the potato had become so important to the Germans.

lmate that is ill suited to the potato). The potato in a country with potato climate may, e taken as a sign of land scarcity.

the United States.—Owing to the average r to raise corn and to buy higher priced foods,



ɔotato production, ɾage, 1910–11.

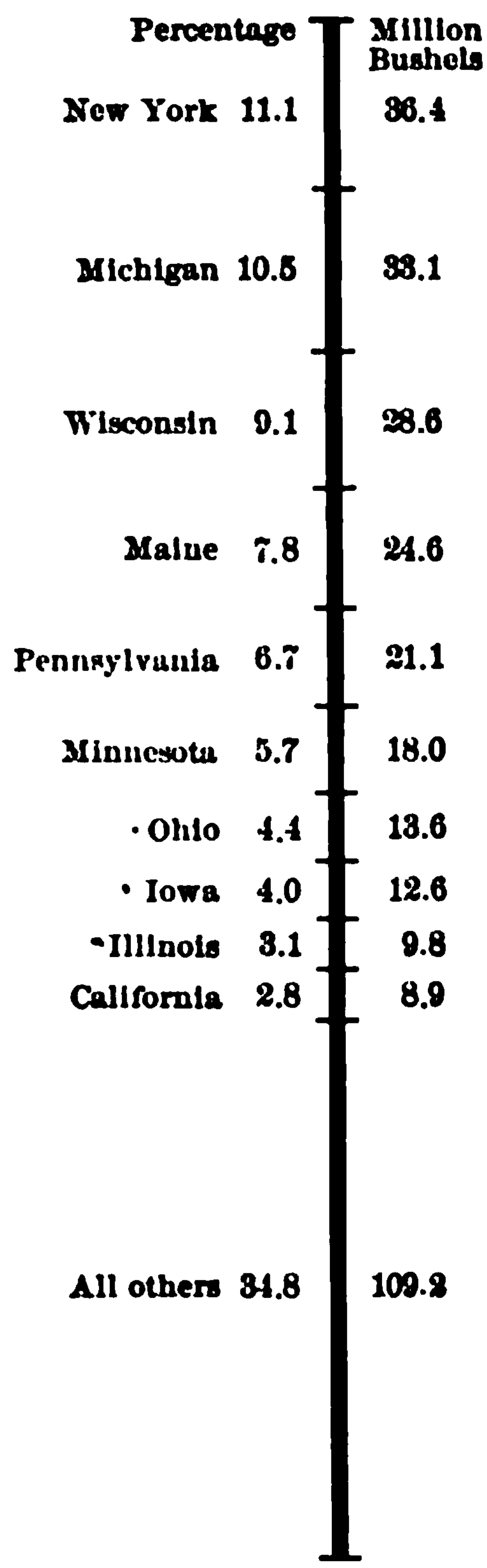


FIG. 47.—United States potato production, two-year average, 1910–11.

sought as food in America than it is in Europe. of its growth lie north and east of the corn belt. ng the production in the ten leading states ctly the potato separates itself from the corn ːn state being in the list. Michigan has a good

corn belt in the southern end of the lower peninsula and an important potato production in the rest of the state. It is grown to a great extent as a money crop in certain sandy areas in Wisconsin, Michigan, and also in parts of Pennsylvania, New York, and New England. In the adjacent and similar parts of Canada it is of even greater relative importance.

U. S. POTATO CROP, 1911

Wisconsin	32.5 million bushels
Michigan	31.0 million bushels
New York	27.8 million bushels
Minnesota	25.9 million bushels
Maine	21.2 million bushels
Penn	15.1 million bushels
Iowa	12.9 million bushels
Ohio	12.4 million bushels
Cal	9.7 million bushels
Wash	9.4 million bushels
Total for U. S.	292.7 million bushels

The growing of potatoes as a money crop tends to become very much concentrated in certain districts. In Aroostook County, in the St. Johns River Valley in northern Maine, agriculture, which had greatly declined, has suddenly revived through the rapid rise of potatoes as an export money crop for that district. Similarly, Monmouth County, New Jersey, between New York and Philadelphia, has become a potato center, shipping to the two great cities as much as 600,000 barrels in a single season. The sandy soil of the Atlantic Plain from the east end of Long Island to Florida is much of it better suited to potatoes than to grain crops; and on eastern Long Island, as in the only two counties of Virginia that lie east of the Chesapeake, the shipments of potatoes have within a decade made the farmers very prosperous.

The Supply of Early Potatoes.—The supply of early potatoes for northern markets from southern lands gives rise to an important industry in many parts of the world. Thus, Algeria derives a large income from potatoes which reach Paris in thirty-five to forty hours. Egypt sends the first potatoes of the season across the Mediterranean to northwest Europe. In American

ly of new potatoes comes into the market
a the islands of Bermuda, situated 600
in the latitude of South Carolina, in the

nted after a 200 bushels to the acre crop of potatoes.
the corn—three crops in one year. Eastern North
ge areas. (Photo Manufacturers Record.)

shed by the Gulf Stream. This greater
ure of the oceanic as compared to the
as becomes the basis of Bermuda's chief

export. The next potatoes for the northern cities of the United States are from Florida, where there is but little frost and potatoes can grow most of the winter. Then, as the spring advances northward, other accessible points in the Atlantic Plain, such as Savannah, Ga., Charleston, S. C., New Berne, N. C., southeastern Virginia near Norfolk, the peninsula east of the Chesapeake Bay, southern New Jersey and Long Island, in turn send their carloads and trainloads or shiploads of new potatoes to the northern and western states. Throughout the winter and early spring the price of new potatoes in northern cities steadily declines as spring moves up the coast from Florida to Long Island and each locality holds the market but a short time. Yet this warm, coastal plain is not the ideal place for the potato; and the whole plain from end to end does not produce as many potatoes as the state of Maine. To keep the potato plant from degenerating, the Coastal Plain crop is regularly grown from seed potatoes produced in Maine where the species maintains the desired vigor and rapidity of growth.

The main supply of the country for the winter months comes from the northern potato districts between Maine and Minnesota.

The potato is also important in the irrigated lands of the Rocky Mountains and Pacific states where the cool nights forbid the growth of corn and the expense of irrigation demands a heavy yielding crop.

The Potato in Foreign Trade.—On account of the great bulk and weight of potatoes in proportion to value, and because of their perishable nature, they are much less important in international trade than in home production. As a whole, they have a tendency to become a national supply crop, with commerce limited to emergencies and early supplies. When, as occasionally happens, we have a shortage in this country, they come to us by the hundreds of thousands and even millions of bushels from Canada, Ireland, Scotland, Germany, and Egypt. We have normally a small export of potatoes to Mexico, Central America, Cuba and the other West Indian Islands, where the warm climate makes their growth unsatisfactory,[1]

[1] The potato varieties now in cultivation are from the wild potato of cool plateaus in South America. Those in low-lying tropic lands have thus far been neglected.

: the population has a taste for this northern
ply. In normal years our export is larger

lation to the total value of the crop, the
n trade in potatoes are conspicuous for their
he irregularity of the amounts.

	Potato exports, million bushels	Potato imports, million bushels
	1.53	0.17
	1.20	0.40
	0.76	8.38
	1.00	0.35
	2.48	0.22

w that the potato production is limited by
nd not at all by the land possibilities. Our
in potato fields are an insignificant patch.
the market, and actual overproduction or
duction and the consequent low price is the
potato production. The price to the grower
ten cents and a dollar a bushel, between
large profits. The existing farms and men
America could, if assured a price of a cent a
le the potato crop without producing any
ning of other crops, and there is abundant
or twenty times as many potatoes without
er crops. If we had the facilities for making
lion or 400 million bushels of potatoes into
a boon to American agriculture. Agricultural
a fact of unappreciated importance in con-
tion of perishable commodities.

2. THE SWEET POTATO

: is often said to have great possibilities for
man life. One evidence of this is the great
ch-producing plants. One of these is the
ch causes the tropic denizen to have small

regret over the fact that the white potato will not grow there. The sweet potato supplies the same need in human diet, and differs from the white potato only in the greater amount of sugar and nourishment that it contains (see table, page 99). The sweet potato is a perennial where there is no frost, yet it will grow a crop in the warm summer as far north as Iowa or New York, and is a crop of considerable importance in American agriculture. Fortunately the sweet potato requires even lighter and sandier soil than the white potato and is, therefore, much grown on the sandy lands of the coastal plain in New Jersey, Maryland, and Virginia, where it is largely produced for shipment to the northern states. Similar sandy spots in Iowa, Illinois and the North-central States render similar service for the interior of the United States and western Canada. This crop is also very widely grown throughout the Southern States as a local food supply, where the people have the alternative of rice or sweet potatoes as their chief starch food in addition to corn bread.

Importance of the Sweet Potato in the Tropics.—In the torrid zone, its original home, the growth of the sweet potato is almost universal, whether it be in the Spanish-speaking settlements of South America, the English-speaking Honduras, the West Indian Islands, the coasts of Africa or the Malay Peninsula. Some varieties called yams grow large enough to weigh 40 or 50 pounds, but they have almost no commercial importance in the tropics because of their many rivals, the universal ease of their production, and the fact that there are few tropic cities large enough to require large movement of agricultural products.

3. CASSAVA

Cassava is one of these tropic rivals[1] of the sweet potato that helps to fill the local need and furnishes tapioca for the peoples of the temperate zone. The United States imported 60 million pounds of cassava and tapioca in 1911 at an invoice cost of 2.3 cents per pound—a low figure which indicates the great

[1] In Jamaica, one of the few tropic territories with statistics, cassava ranks third among the ground provisions which are the principal articles of food among the natives, yams coming first and potatoes second. U. S. Con. Rep., June 2, 1912.

to man. Like the sweet potato, cassava is rch-producing roots. The plant reaches a set, and develops roots about 2 inches thick nuch as 6 feet long (usually much less). It erica; but it is distributed throughout the isively used for food in many districts, espe- uiana, the West Indies, West Africa, the s and the Malay Peninsula. In all these are a standard article of diet for the natives siderable extent the corn bread of the Ameri- oiled potatoes and rye bread of the European er breadstuffs of the temperate zone.
g the Gulf coast seem to indicate the possi- cassava growth in the United States.[1] In itious starch, the cassava root also contains known as prussic acid. Fortunately this emoved by washing the grated root in water, g.

4. THE BANANA

other great starch food, a rival of the potato, rice and cassava. It has been cultivated d to produce seed. Wherever the climate is he rainfall suffices to support a dense tropic s at home. The banana belt goes round the slightly into the north temperate zone. hes of fruit it stands almost without a peer s to man. Wheat, corn, rice, and the potato labor and tillage, but one may stick a root the favorable tropical earth, give to nearby blows with the machete (a sword-like knife pics) to keep the young banana plant from nd, in a few months, it gives its great gift s thereafter the shoots which the original inue to furnish food throughout most of the

ich the common ornamental Caladium or elephant's tarch-yielding root, a potato substitute, and is culti- the extent of 100 species. It also grows in southern

year. The amount of food per acre is greater than from : grain but far less than is often reported. Three hundred bunc per acre (U. S. Con. Rep., 1911) is considered a good crop Jamaica, and the drain upon the soil is less than that made b small crop of wheat. The common absence of plowing redu to a minimum the soil waste from erosion which has nearly destroyed the ancient world.

This ease of banana production should be emphasized in effect on tropical life. More than any other one plant, it he to make life easy in the tropics. In the Congo Basin and ot humid parts of central Africa, where the climate is so bad the white man, the nutritious banana is said to be the main arti of diet for many, probably scores of millions, of the negro ra It merely replaces the potato of the north European peasant, a the rice of the southern Chinese. Scores of varieties are gro throughout the East Indies, south China, much of India, ma of the West Indian Islands, the Philippines and other tro lands from Mexico and Hongkong to Argentina and Queensla

Banana in Commerce.—Owing to the perishable nature of fruit and consequent necessity of quick transportation, it has n been long known to many people in the temperate zone. I a gift of the tropics delivered to the temperate zone by the c driven steamship which is destined to bring us many ot valuable gifts of a like perishable nature. For thirty years pr to 1899 the consumption of this fruit in the United States h doubled every five years. Since that date its use has stead increased, because it is in many places the cheapest food that c be bought in America to-day. It competes with the cereals, t limited extent with our home-grown fruits, and with the pota of which it is almost a duplicate in nutritive content. (S table of food values.)

Because of the difficulty of transportation, only certain favo locations in the tropics are near enough to the markets to exp the banana. The supply in Europe is inferior to that in t United States because that part of the tropics lying near Europe is the Desert of Sahara, where the banana cannot gro The European supply has for a long time come from Madeira, t Cape Verde and the Canary Islands off the west coast of Afri but within recent years fast steamers have begun to carry t

est Indies and Central America to England.
he influence of nearness to market on banana
be pointed out that an acre of banana land in
ituated and with water for irrigation purposes,
lthough more productive land not needing
ed in the West Indies, Central America, and
below Sahara.

Caribbean Countries.—The nearness of the
ie steaming hot plains that border the Carib-
Gulf of Mexico has given us a favorable place
aw our supply of bananas. Owing to the
te along the Central American coasts, nearly
n the more healthful interior plateaus and the
have long lain idle. The comparatively new
however, has caused recent rapid increase of
West Indian negroes, and commerce along
sts. American enterprise has built railroads
antations near many of the ports and sent
product. When the shiploads of bananas
ey are hurried on express trains to the in-
Orleans, latitude 30°, whole trainloads are
d northwestward into the lands of cotton,
atitude 40°–42°, and across the continent to
where they come into competition with the
to San Francisco and Seattle from Hawaii.
ighly organized international trade a hungry
of many American cities can be better fed
th of bananas (usually two or three bananas)
cents' worth of bread.

ly new trade has been little short of revolu-
ts it has had in making new industry in the
l Toro, Panama; Limon, Costa Rico; Puerto
o; Port Antonio, Jamaica; Santa Marta,
her Caribbean ports. The 4 1/2 million
rom Boca del Toro in 1910 made up prac-
xports from the large territories of Panama.
room on the Caribbean for more plantations

ianas which has been begun in Jamaica gives

possibility of producing the fruit in indefinite quantities because the ease of transporting the dried product will permit remote localities to send them to market.

Difficulties of Banana Growing in the Hurricane Belt.—The people who live upon the shores of the Caribbean and the Gulf of Mexico have a double dependence upon the banana. It is to them a great supply crop because it is a standard article of food, and to many of them it is also a very important money crop. Jamaica shows its importance as a money crop. Fruit exports of that island, chiefly bananas, have risen from $15,000 in 1869 to $350,000 in 1879, $1,500,000 in 1889, $4,000,000 in 1899, and $7,500,000 in 1909; and increases are still expected and the banana area is extending. But the banana is a vulnerable crop. Thus, in February, 1899, when a fearful hurricane swept across the West Indies the farmers could do nothing for their banana trees which, with their heavy burdens, and weak stems, were an easy prey to the furious thrashings of this storm. Consequently, the million inhabitants of Porto Rico who were supporting themselves almost entirely by agriculture, on a hilly territory less than half as large as New Jersey, found, when sunshine returned after the storm, that their bananas were beaten to the ground. As a consequence the island was upon the verge of famine for nearly a year until another banana crop could spring up from the roots of the old plants. Yet the Porto Ricans then as now did not export the banana largely. It was a supply crop for their own food while they produced coffee, sugar and tobacco for the foreign market. More recently a similar storm destroyed the bananas in Jamaica and the lines of steamers that had been carrying the fruit to the United States had to discontinue for some months pending the growing of another crop. In Bermuda, which often comes under the influence of several tropical hurricanes each year, the wind is so strong that the bananas can grow only in a few limestone sink holes which, like protecting walls, shelter the plants on all sides.

5. MANUFACTURED STARCH

Starch in the Form of a Dry Powder.—Manufactured starch serves many uses among civilized man and is produced from a large number of starch plants by methods which, in nearly all

As starch can be easily washed out of the
es of a starch-producing substance, a plant is
, the starch washed out in water, and allowed
few washings the starch is ready for market.
starch is separated from cassava; and then is
ps by being slightly heated, after which it is
This industry might be carried on almost any-
parts of the zone where the labor supply is
e work. The chief supplies come from the
of the Malay Peninsula, being chiefly pro-
vorkmen living under the British rule. Brazil,
tion of negroes and Portuguese in and near the
her important tapioca producer.

ferent plants have a different shaped grain and
. In some of the New England States, New
n, much starch is manufactured from potatoes
the potatoes, grating them into small bits
ving machinery, and soaking out the starch.
alue chiefly in sizing, that is, to hold together
e manufacture of textile goods.

s made from rice. A small amount of starch
at for use in dyeing textiles. The form of
h most commonly made in the United States
n, there being starch factories in many towns
ates. This corn starch is used in American
especially as the raw material for the manu-
, one of the sugars discussed in another

the Far Eastern Tropics a form of starch is
sago palm tree and extensively used as local
va, Borneo, Celebes, and adjacent islands.
tree is about fifteen years old it blossoms
ces a large amount of fruit. Before blossom-
for the production of this fruit is stored in
in the form of starch. To get this accumula-
alays, just before the tree blossoms, chop it
et long, soak out the starch, dry it, make it
or the "pearled" rounded masses which are
cery stores as sago.

Future Supply of Starch.—Considering the wide variety of plants and climates and soils yielding starch, and the fact that the tropic sources have scarcely been touched by modern scientific enterprise, it is plain that there is no scarcity of starch foods in sight.

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CHAPTER V

HE ANIMAL INDUSTRIES

IEAT AND THE MEAT SUPPLY

eoples of the world, meat is something of a
oming more so. That it is not a necessity is
; that millions of people rarely eat it and many
are even forbidden by their religion to eat flesh.
f the table of food values shows the sufficiency
, a fortunate fact, for many millions of the human
Europe can rarely afford to eat meat because
It is a luxury possessed chiefly by the people
e population, where for that reason meat is
'ays has the choice of eating plant products
1 is cheap and plant products abundant, he can
nals and then eat the animals. The latter is
xpensive form, for the making of a pound of
: grass from much land or 5 to 10 pounds of
ent of eight to fifteen 1-lb. loaves of bread. In
egions where there is not food enough for both
ian eats the food and does without the beasts.
at Animals to the Density of Population.—
resents the most extreme example of a people
high civilization with few animals. With the
orthern Island of Hokkaido, the whole country
of from 400 to 500 people per square mile; and
eep country permits but a sixth of the land
The apparent room for pasture does not exist
nse growth of bamboo grass wholly unfit for
le to eradicate." The effect of this absence of
ure of population in limiting the production of
is most marked. The Empire has nearly
ople, and of horses and cattle combined but
many, while the number of sheep and hogs is

but 1/8 of 1 per cent. of the number of people. Both of these figures are utterly insignificant in comparison to those for the United States (113 and 130 per cent. respectively), or even to those of Europe.

Denmark is an agricultural country where some meat is eaten and animal products are an important factor in commerce. This country (74 per cent. fields and pastures), has four or five times as much of its area suitable for farms as Japan, and has passed the limit in the number of animals it can support on native food,

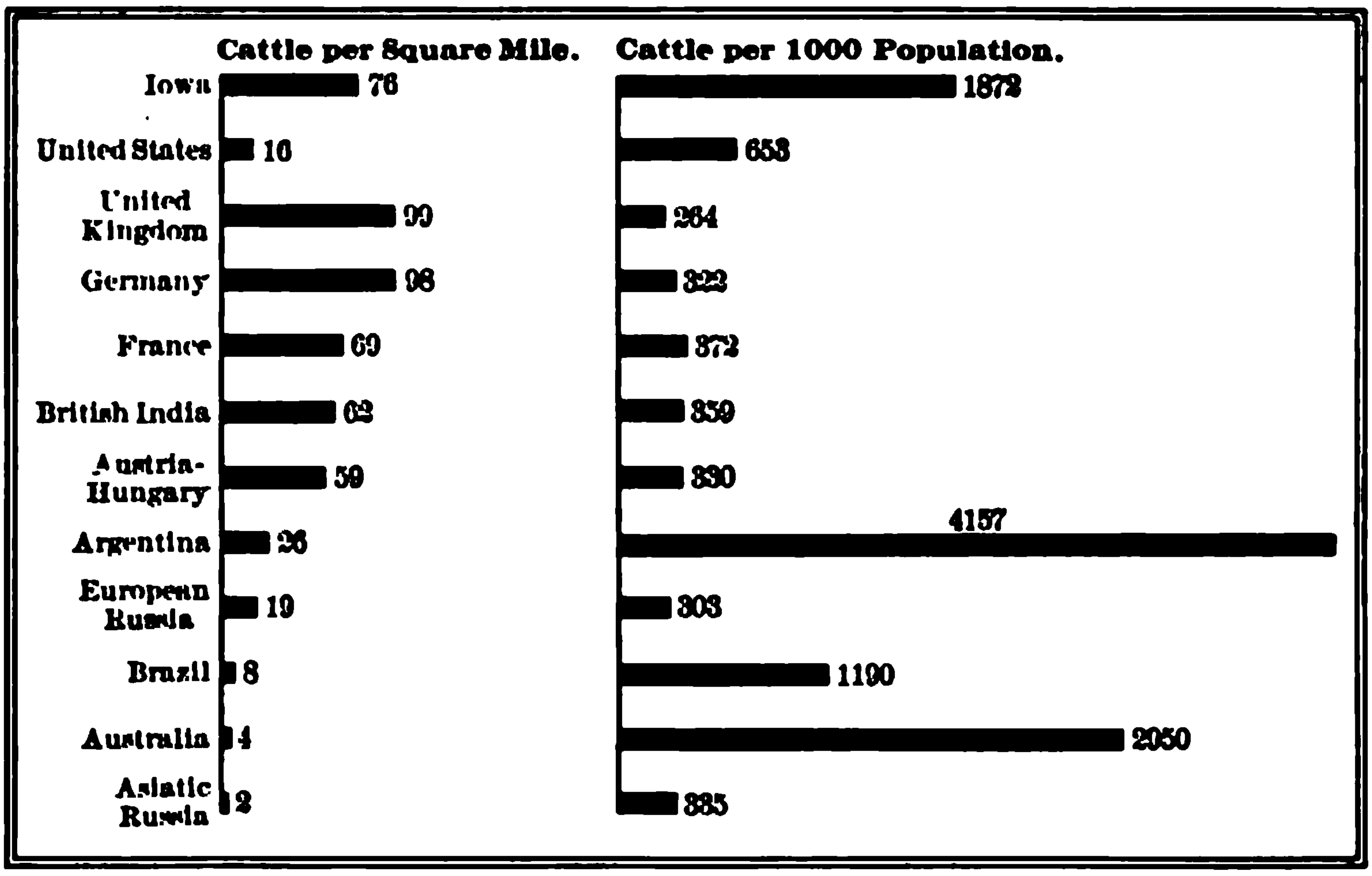


FIG. 49.—The chart of ratios of cattle to land and to population shows how the frontier leads in one respect and the old lands in another.

since cattle foods such as wheat bran, cottonseed meal, linseed oil cake, and other grain products are being imported in large and increasing quantities from the United States, Argentine Republic, and Russia. The Danish population is 167 to the square mile and horses and cattle are 90 per cent. as numerous, while the sheep and swine reach about the same percentage. The state of Iowa, practically all arable, a strictly agricultural state in the midst of the corn belt, is far better fitted than Denmark to support livestock; but it has less of them per square mile than Denmark, having but forty persons to the square mile with a horse and cattle ratio of 300 per cent. and a sheep and swine ratio of 330 per cent. of this population.

Great Britain are examples of countries where
pulation has carried them beyond the position
er toward the condition of Japan. The
to the square mile in England and Wales,
and 136 in Ireland. There are 31 per cent. as
horses as people and 74 per cent. as many sheep
d, with a relatively sparse population for west
siderable export of meat to England, and main-
cattle ratio of 155 per cent. and sheep and
3 per cent. of the population, thereby also far
n actual numbers per square mile. Yet the
ited Kingdom are the greatest meat-importing
d.

mile of the fertile and well-tilled Holland are
attle and horses 33 per cent. as numerous, and
ine but 25 per cent. Meat is imported into
the Dutchman eats less meat on the average
nglishman. Intensify agriculture as we may,
inevitably find meat scarcer than do sparse

in Sparsely Peopled Lands.—By turning to a
rse population, the reverse of the above con-
heap and abundant supplies of meat for home
surplus for export. In the United States the
n is about thirty to the square mile; the num-
and horses are 113 per cent. of the population,
heep and hogs 130 per cent. The high ratio
makes the United States a great exporter of
it the countries to which we send meat exceed
of animals that they produce per square mile.
ites there are on the average about thirty-five
per square mile. In Great Britain and Ireland
in Denmark and Holland 150 per square mile.
decline in the ratio of meat animals to man as
ple is rapidly raising the price of meat in the
l has, according to some estimates, cut in half
it consumption in the United States since 1840.
rease in prices has occurred since 1901. In
have lost nearly one-third of our per capita

supply of cattle, two-fifths of our per capita supply of sheep, and one-fourteenth of our per capita supply of swine. The figures do not entirely show the facts because the average size of the slaughtered hog has declined and there has been absolute increase in the number of milch cows at the expense of beef cattle.

POPULATION AND ANIMALS IN THE UNITED STATES, 1870-1912

	Population, million	Cattle of all kinds 1,000	Per cent of population of United States	Hogs 1,000	Per cent of population of United States	Horses and mules 1,000	Per cent of population of United States	Sheep	Per cent of population of United States
1870	38.6	25,483	66	26,751	69	9,427	25	40,853	106
1880	50.2	33,258	66	34,034	68	12,930	25	40,765	80
1890	62.9	52,801	83	51,602	82	16,544	26	44,336	67
1901	77	62,333	80	56,982	75	19,648	25	59,756	77
1912	93	57,959	62	65,410	70	24,871	27	52,362	56

The southern hemisphere with its newer and sparser settlements gives us the most striking examples of animal abundance. The Argentine Republic is half as large as the United States, but the population, less than in some single states of the American Union, is but 5.7 people per square mile on the average, and only 16 per square mile in their best agricultural province. The wealth of animals is astonishing in comparison with Japan, Europe, or even the United States. The percentage of cattle and horses to population is 550 per cent (1910) and of sheep and swine, 1,000 per cent.

In Australia, similar conditions prevail. The continent has nearly 3 million square miles, and while much of it is a desert, there are large areas suitable for keeping animals. The sparse population of about 1 1/2 per square mile has for each 100 people 280 horses and cattle and 2,100 sheep and hogs—chiefly sheep. These figures show why meat and other animal products make up such a large proportion of the exports of these sparsely peopled south temperate zone countries.

2. SWINE

Qualities and Distribution of the Hog.—Swine are meat animals of grain-growing lands, as the sheep is of grass-growing

storal Australia has 100 sheep to one hog, corn state, has seven hogs to one sheep. The ly an animal of forest countries living upon s, grubs, and other highly Consequently, in domes- have somewhat similar small stomach is not omplete diet of bulky original forest home he indance of autumn nuts t which covered his body through the hungry time efore, the rich grains of exactly. He is still fond orns of his original forest to eat anything from a garbage to the weeds pulls from the garden. hardy, and fecund[1], the ible door-yard scavenger er for the cottagers of has attained an almost bution, being of great as a food supply in many ie is of no commercial friend of the Irish and and of the new settler in He lives around the -breed Indian of Mexico ca, and is as friendly to Italian immigrant in the as around the stone house s of Europe. He is as much at home beneath negro in the West Indies as by the palm leaf of the Congo or the coast of Guinea. In the

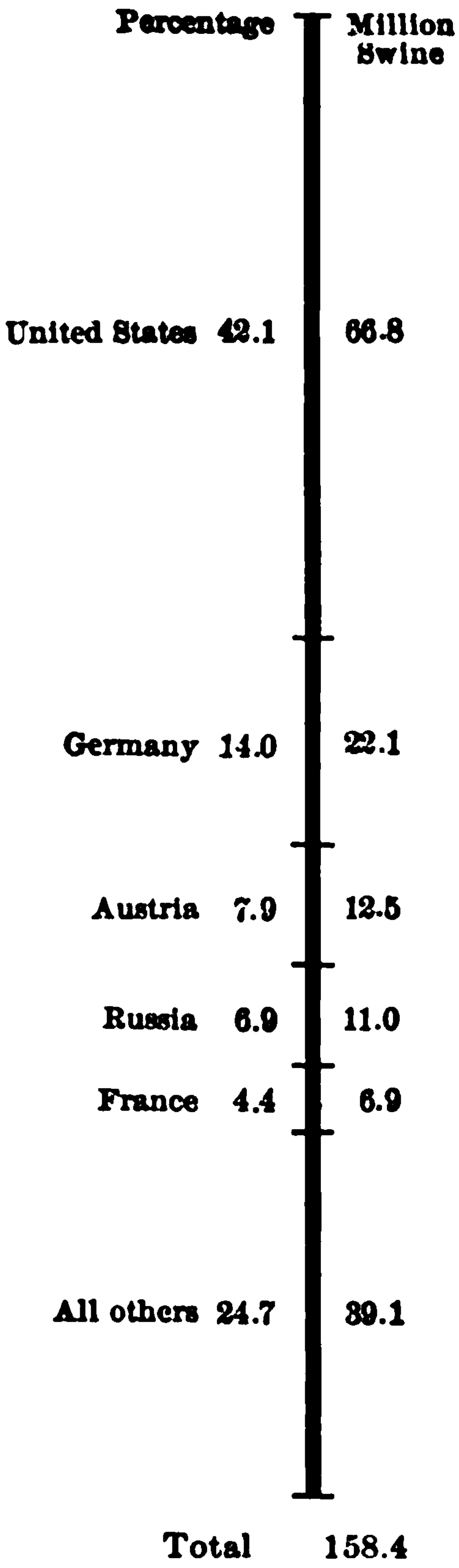


FIG. 50.—World distribution of swine, 1911.

f sheep that increases 100 per cent. per year, while ten e of swine is common. The United States slaughters t of its hogs, 39.8 per cent of its sheep, 26.8 per cent thus appear good reasons why pork is the cheapest

eastern world he is common in China, Malaysia, Australasia, and the mid-Pacific, where, in at least one group of coral islands, the price of a dusky bride is from ten to twenty pigs.

Hogs that Range in Forests.—In many parts of the United States it is customary to let the hogs run in the forest where the fallen mast provides a large part of their food. This occurs in the Appalachian Highlands, in the Ozarks of Missouri and Arkansas, and in many parts of the South Atlantic and Gulf States. Great injury to the southern pine forests often results from the up-rooting of the young pine tree which the hog kills by eating the succulent tap root. In the southern states, salt pork, easily kept in a warm climate, is the staple meat food of the working man, white and black alike.

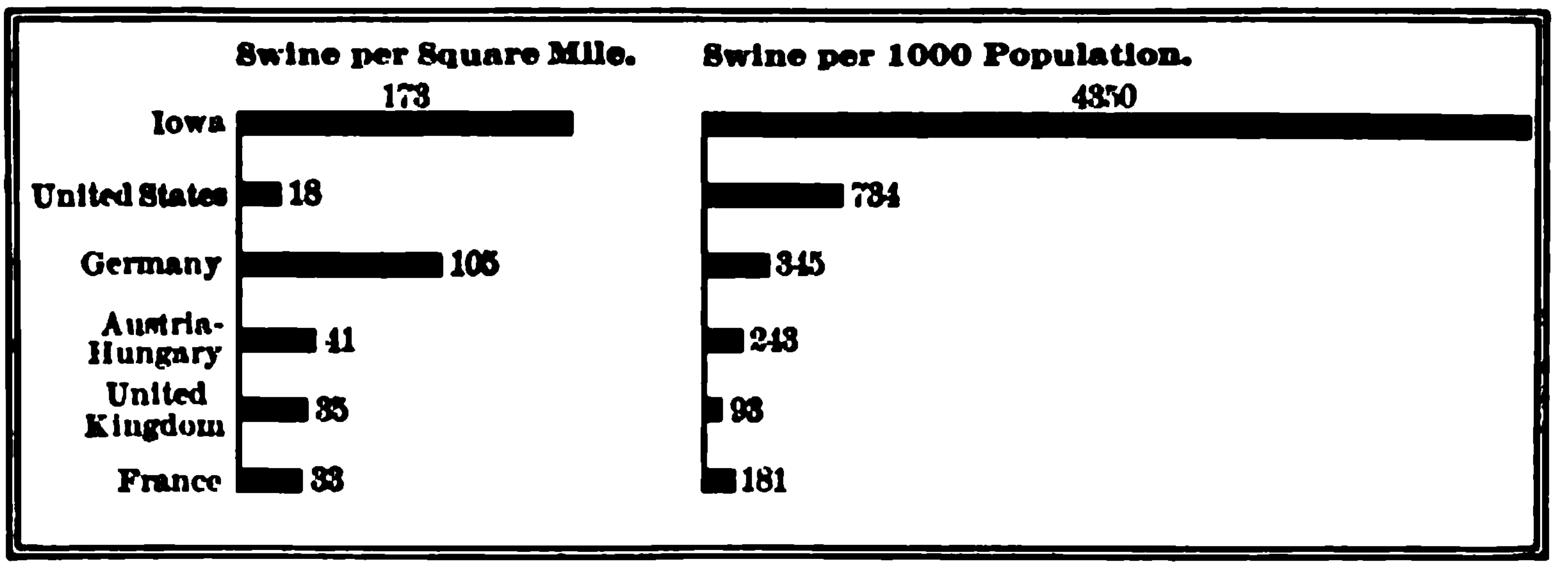


FIG. 51.—The ratios of swine to land and to people show that meat exports are products of sparse populations.

Hogs fatten in many south European forests. An important hog-raising district is located in southwestern Germany, where the animals can roam the beech forests and live on the beech nuts. In Servia, hogs, largely mast fed, rise to the important place of chief export. The fertile valleys of this mountainous country are carefully farmed chiefly for grain, but in the oak and beech forests of the mountains there is excellent feeding ground for hogs, which are sent to Budapest and Vienna and to Germany. But the mast-fed hog is of relatively small importance in comparison to the grain-fed hog.

Relation of the Hog Industry to Grain Growing.—Since the hog must have some kind of concentrated food such as acorns, nuts or grain, he is a natural product of the regions producing cheap grains. The chief regions producing hogs for export,

ose in which corn or barley abound. Since
n the cheapest and also the most fattening of
nce corn is much more important than barley
corn belt of the United States is the leading
gion of the whole world.
of this corn belt, twice as
ound in the United States
wo countries of the world.
owa, Kansas or Nebraska
ows one or two fields of
keeps from 20 to 100 hogs,
almost entirely upon the
e-third of the American
the market in the form
to the great ability of this
fat, the American hog is
'lard hog," because of the
ard (melted fat) he makes.
erent from the so-called
the barley-growing dis-
nd Europe. Owing to the
ields less grain and there-
o produce than corn, the
Canada and Europe feed
ch as possible on grass,
This food, rich in protein,
an meat in the pig's body
rn diet and for this cause
h breakfast bacon has the
with the fat. Because of
ness, some English bacon
he United States, although
llions more hogs than any

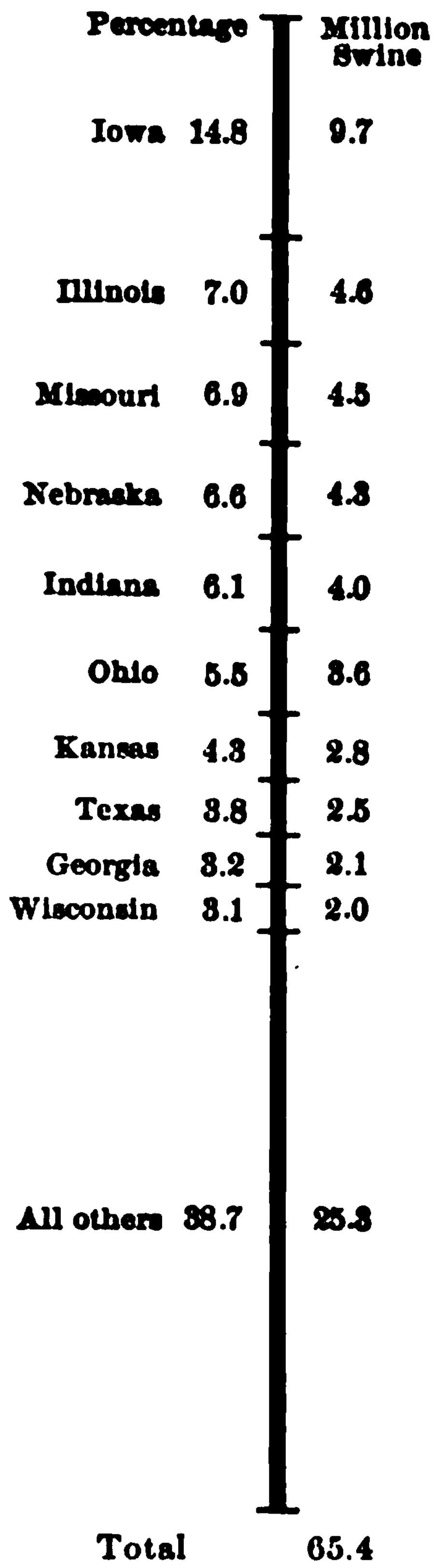


FIG. 52.—United States distribution of swine, Jan. 1, 1912.

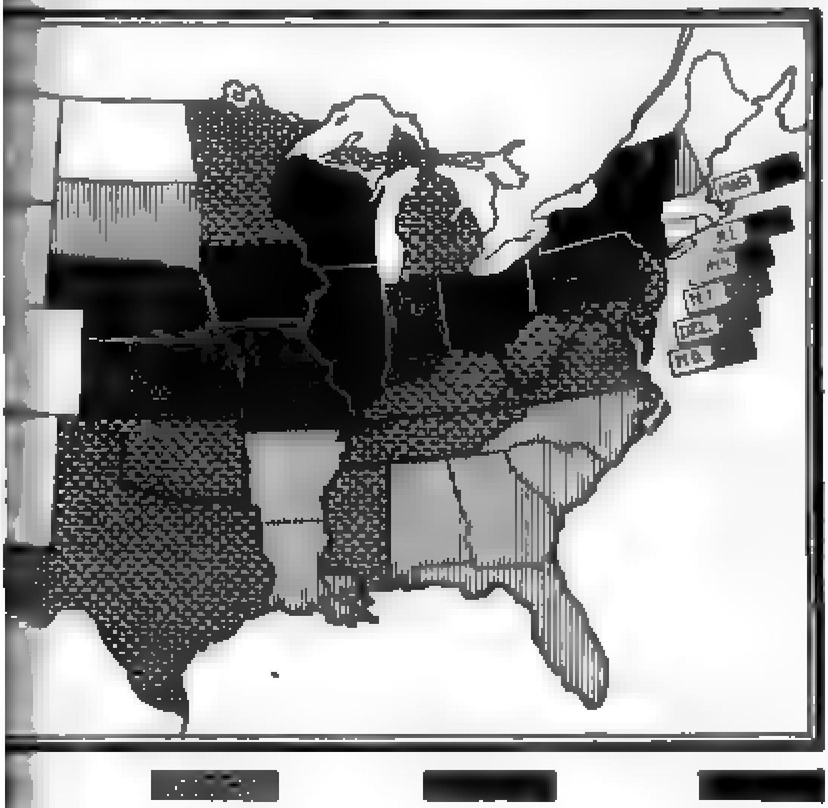
l send vast quantities of cheaper pork to England
the same time that Ireland imports American
bacon of high quality, which is exported to
ket. The most important center of European
owever, is the barley region adjacent the Baltic
and Russia, Germany being second only to

the United States in the number of hogs, and Russia third. Hungary with its corn crop is also an exporter of pork to Austria and Germany.

3. DISTRIBUTION OF CATTLE

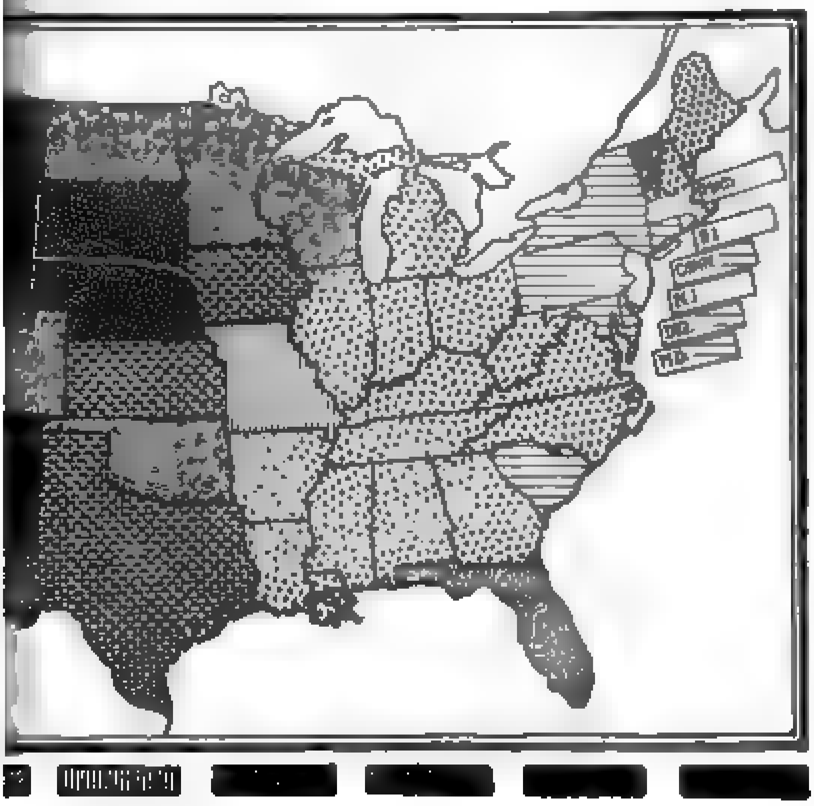
Wherever there are wide spaces of untilled grass lands we are likely to find cattle. They were pioneers during the nineteenth century upon the vast plains that the white man won from the wild animals and savages in North America, South America, Australia, and central Asia. On account of their size, strength, and speed, they can combat dangers, or, if necessary, flee from them. Their ability to withstand heat and moisture has enabled them to go into lower latitudes than sheep. With the exception of the humid plains of the Amazon and central Africa and a few places in the Oriental tropics, they are to be found from the Straits of Magellan to Hudson Bay in the Americas, and from Tasmania to Kamchatka and North Cape in the Old World.

In the first stage of the occupation of new plains, before transportation has been well developed, the only export products cattle can furnish are the non-perishable hides and tallow. Fifty years ago the half-breed Indians on the plains of the Argentine were producing these commodities at the same time that the American Indian and frontiersmen were skinning buffalo for their hides upon the great American Plains reaching from southern Texas to Lake Winnipeg and beyond. This vast plain was a splendid pasture and had been occupied by the buffalo, a close relative of the ox, for an unknown period of time. They wintered in the warm lands from Oklahoma to Mexico and each spring went north across what is now northern Texas, western Kansas, Nebraska, Dakota and on into Canada. With the approach of winter they migrated south, the herds often covering the plains for miles in such great numbers that they actually stopped the progress of trains when the first railroad was built across the plains from Omaha in 1868. In the next four years, many millions of buffalo were slain for sport or for their skins, and now this great animal is practically extinct, except for a few herds in National Parks, private reserves, and



20–30 30–40 over 40

d States per square mile, by states, Jan. 1, 1912.



) 600–1000 1000–1500 1500–2000 2000–3000 over 3000

l States per 1000 inhabitants, by states, Jan. 1, 1912.
. S. Dept. Agr.) Pop. 1910.

zoological gardens. His place was promptly taken by the long-horned Texas cattle which had run wild with him for three centuries since their ancestors had got away from the early Spanish settlers. In living with the buffalo on the plains they had become quite well adjusted to the conditions of the life. Their long horns were admirable defense against wolves and bears, their long legs and muscular bodies were efficient in flight. But the animal himself was not very good for beef and so he has been improved by crossing with better breeds brought from England.

The earlier part of this chapter showed, however, that cattle reach their greatest density in districts of comparatively dense population.

Cattle on the Great Plains of North America.—The great open plain west of the one hundredth meridian was too dry for good farming; therefore the pioneer farmer could not take it, as he had taken up all Iowa and the eastern parts of Kansas and Nebraska. The United States Government, to which the land belonged, would not sell it, for fear of great estates and land monopolies. Although it was excellent pasture for a few cattle per square mile, no one could afford to take it even as a gift, under the homestead law which gave 160 acres to each settler, but limited his acquisitions to that amount. In a land fit only for scanty pasture, a man needs hundreds of acres. So this vast area of the plains, larger than any European country except Russia, remained every man's land, as the Government would not sell it and people could not take it as a farm homestead. People branded their cattle, turned them out upon the plain in great numbers, and then, after an annual round-up when all the cattle in a large area were brought together, each man took the cattle that had his brand and sold them. This was a very cheap way to raise cattle and very profitable for the cattle companies. It made cheap beef for market and along with the settlement of new cowlands west of the Missouri River, it led to the high figures for animals as shown in the table of animals and population. The freedom of the range naturally led to an overstocking. The grass, especially in periods of drought, was eaten so close that it could not produce seed, and in many places it died out so that the plains do not now support so many cattle

nd are being greatly injured by both wind and
by the advance of inedible weeds.
of Beef Cattle.—The range cattle spend one
n their native plain, living on grass, and are
the Corn Belt where the
m for a few months, fat-
corn before sending them
arkets for slaughter. To
cattle are fattened in the
lvania and other eastern
s 60,000 a year being dis-
city of Lancaster, Pa.,
and well-cared-for farms
To a smaller extent this
s repeated in the Southern
e hilly country of south-
northeastern Tennessee
a, there is a section of
y where young cattle are
o the farm lands of the
he Piedmont sections of
land for fattening.
**Cattle on Arid Lands
tion.**—Irrigation in the
t to the cattle industry.
chief commodity shipped
irrigated districts of the
lfalfa leads all other irri-
area under cultivation.
richest of all the clovers.
to great depths in the
the moisture supply is
heavy crops of hay, in
uttings a year according
nately, the irrigable valleys are widely scat-
the cattle range from Canada to Mexico,
as to western Oregon, so that these favorable
eally scattered oases in the scanty and semi-
uring winter and the seasons of drought,

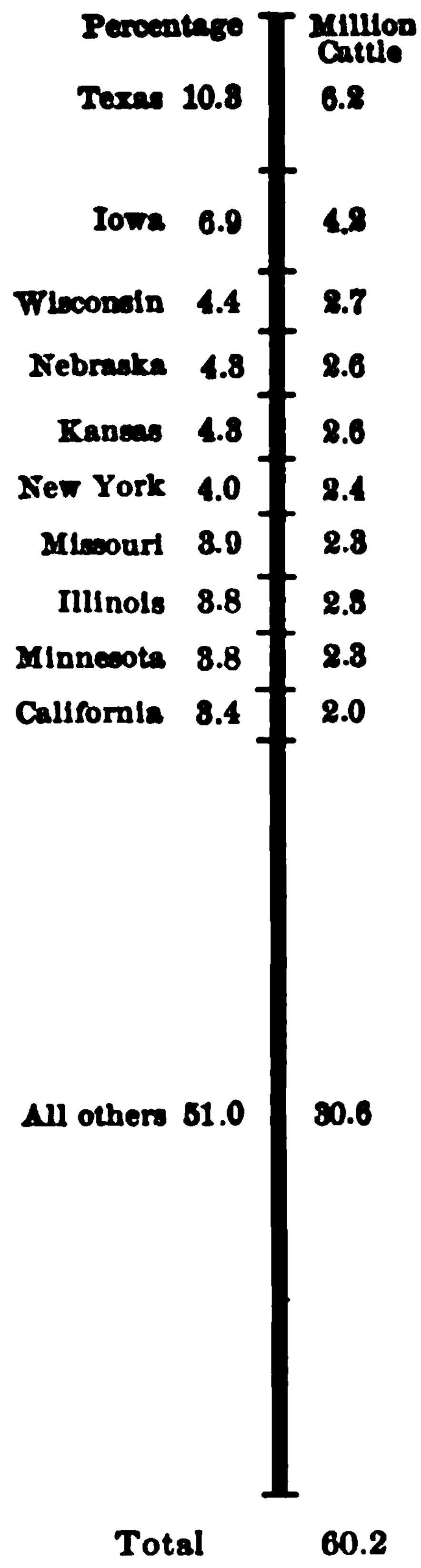


FIG. 55.—Cattle, including milch cows, in United States, Jan. 1, 1912.

alfalfa hay supplies the cattle from the ranges with abundant food and fattens them for market.

Cattle in Southern States.—The southern states have great but unappreciated cattle-producing possibilities. The Minnesota farmer must build large barns to protect his animals and their food from the cold and storms of winter. He must feed his animals full half the year from the results of his summer's toil. In Alabama there is so little winter that a barn is scarcely necessary and the growing season is so much longer that more forage can be produced on a given piece of land than in the Northern States. The cattle can also pasture nearly all the year, thus making the industry require less capital and labor than in the North. The great advantages of the South for stock raising have not up to the present time been used, because of the great and almost exclusive dependence of the farmers on cotton, a money crop of unusual excellence.

The Shipment of Live Animals.—During the past thirty-five years there have been great improvements in the handling and marketing of meat. Formerly live cattle were carried in trains from Kansas to Chicago, and on to New York and Boston for slaughtering to supply the eastern market. About 1874 we began to ship live cattle to Europe. This long-distance movement of animals still continues, owing to the preference of the British for beef slaughtered in their own country. Steamers from Boston, New York, Philadelphia, Baltimore, and Montreal annually convey thousands of live cattle to Great Britain. They are at times even taken alive from Argentina to England. It is, however, much more expensive to transport live animals than slaughtered ones, because the live animals occupy more space than dead ones, some die on the way, all must be fed, and they always lose weight. The dangers and hardships result in such losses that hogs are not exported alive at all and sheep to but a limited extent.

The Effect of Improved Methods of Shipping and Preserving Meat.—The invention of artificial refrigeration has done much to make possible the slaughtering of animals nearer the place where they are raised. About 1875 the refrigerator car made it possible to send dressed beef from Chicago to Boston more cheaply than the live animals could be sent. In 1879 came a

ermetically sealing meat in cans so that it
ong period, thus giving another force to locate
dustry at the great cattle markets. Attempts,
te packing plants upon the great plains where
lves are produced have resulted in failure.
lack of a market for many of the by-products

eef on trolleys in cold storage rooms. (Joseph Campbell Co., Camden, N. J.)

kinds of meat which the varied market of
onsume. Consequently, packing plants are
t city nearest to the places where the cattle
cinnati and Chicago were the first packing-
Omaha, Kansas City, and, to a lesser extent,
now become great centers. Plants are

being established also at Fort Worth and Waco in northern Texas, but Chicago is yet, as it has long been, the greatest meat-packing center in the world.

The modern meat-packing plant handles cattle, hogs or sheep, according to the demands of the market, and is one of the most wonderful examples existing of speed, mechanical perfection, and the use of by-products. A procession of

Fig. 57.—Cans of food filled by machinery and automatically carried past inspectors, finishers, and solderers who complete the closing of the cans. (Joseph Campbell Co., Camden, N. J.)

live animals goes through a gate and in a few seconds their lifeless bodies are hanging on a little trolley on which they travel past a long row of men, each of whom has his perfectly definite work to do. In a surprisingly short time every particle of the animals has been taken for its particular use and the chief part of the carcass rolls into the cold storage room. So perfect is the utilization of the refuse that absolutely nothing is wasted. Bones are made into knife handles, buttons and small pieces and

or fertilizer; the hair goes for mattresses
estines for sausage casings; the hoofs are
glue. Even the blood is used for buttons
ourposes, the total number of inedible
00. Grease, not
made into soap.
therwise used, go
at product of the
nt as fresh, salt,
kled meat.
lopment of cold
or cars, an ever
of fresh meat is
the great packing
all towns, chiefly
rt of the United
t into the chilled
steamers at the
nt to Liverpool,
Hamburg to feed
f Europe. There
~~rt of pork to the~~
nd other tropical
trade it has the
heap and keeping

Industry.—While
nd by-products to
important part of
ction of meat in
extensive. The
tle in the United
Mexico is 83 million;
on. In many sec-
are an important money crop, and the out-
hem to the more populous regions. Thus,
send stall-fattened cattle to Switzerland.
rainfall and great grass growth, west Eng-
e very important cattle-raising districts.

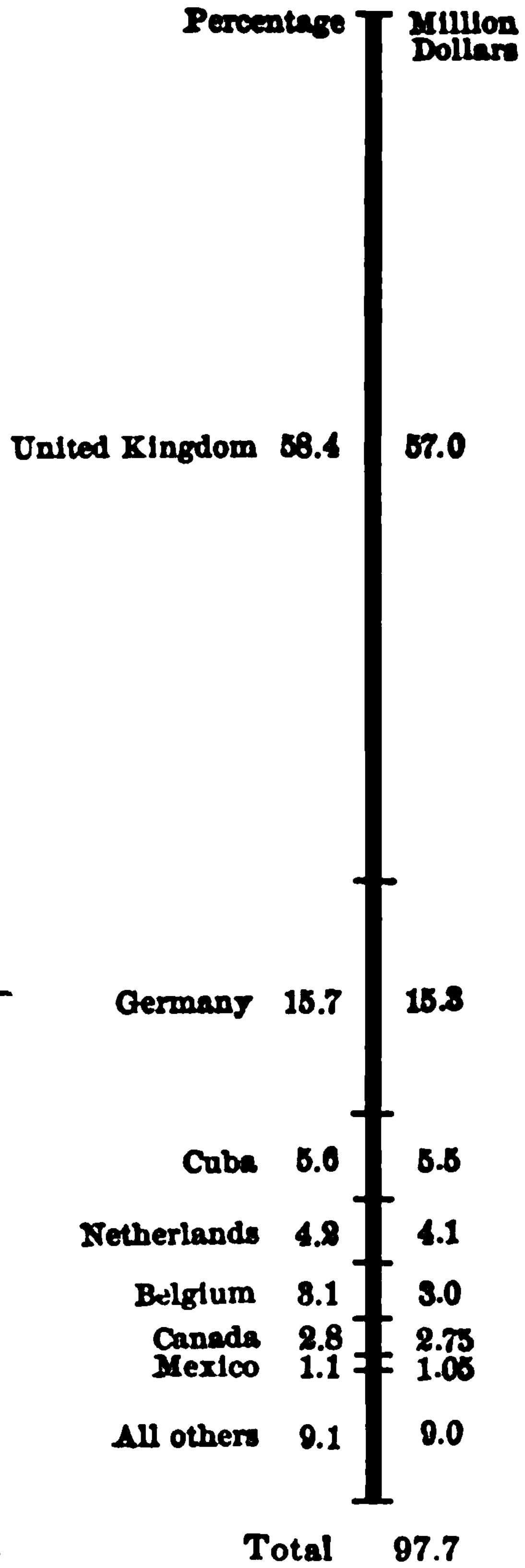


FIG. 58.—Distribution of United States exports of hogs and pork, three-year average, 1909–11.

The moist climate and low-lying lands along the Baltic Sea and English Channel are admirably located for the production of grass and the keeping of cattle, and a previous discussion has pointed out the great development of the industry there. The north of France is well tilled and possesses many cattle. Denmark is a model cattle country which long exported beef to Great Britain. The upland pastures of southwestern Germany and the mountain pastures of the Alps are also famed for their cattle. Most of the cattle of western Europe live in barns and have their food brought to them because by this means the ground can be kept in the cultivated crops which are more productive than pastures. In a day's journey across Germany one will see no cattle at pasture unless it be a field unsuited to the plow. This carrying of food to the cattle is the explanation of the large number of cattle per square mile.

Russia, the greatest cattle-keeping country of Europe, and second of the world, has her vast plains, a part of which, like those of our western states, is too arid for any use but pasture. In eastern Russia there are districts so remote from good transportation that cattle are kept largely for their hides and tallow, as they were years ago in the Argentine Republic, but railroad building is fast bringing this epoch to a close.

Cattle in Old World Arid Belt.—The dry summers of the Mediterranean climate do not produce good pasture, so that in those countries cattle are not so important as in north Europe. Thus, Italy, Spain and Portugal have fewer cattle than Austria, and Italy's percentage of cattle to people is but 7. Cattle are, nevertheless, widely distributed in the arid region and are to be found in limited numbers from Spain to Palestine, Persia, Turkestan, and Mongolia. In the last province the scanty pastures furnish some of the exports of the Chinese Empire. In this land of little rain, which finds its closest counterpart in the American ranges between the Sierras and the Rockies, the methods and the difficulties of the industry are shown by the following excerpts from a U. S. Consular Report from Harput, Asia Minor (June 17, 1911). "A great portion of the cattle, sheep, and goats are owned by nomad tribes of Kurds that wander about this whole country with their flocks and herds. This last winter, however, was the most severe ever known in

snow extended south even down into the sub-
this winter-grazing land the snow was several
ted throughout the entire winter. The people
provide against such conditions. There was
e for the livestock and little for the inhabitants,
'hom and 70 to 80 per cent of the live stock
'

dustry of the South Temperate Zone.—The
refrigerator car, and the cold-storage plant
ble the carriage of meat to market halfway
, so that the ranchers of the south temperate
ger keep cattle for their hides and tallow alone.
ulted for the Argentine Republic, New Zealand,
ountries so admirably adapted to pastoral
ing plants like those of Chicago and Omaha
ellington, New Zealand; at Sidney, Brisbane,
in Australia; at Buenos Ayres and Rosario, in
public; and at Paysandu, across the La Plata
r. From these plants, the frozen carcasses of
are wheeled by the thousands into the freezing
hips which carry them across the entire torrid
em, still frozen, at the cold storage warehouses
thampton, Liverpool, London, and Glasgow.
stributed to the butchers' carts of a hundred
tinental towns. This means cheaper food to
d better prices to the farmer of the south
out it has not sufficed to keep down the price
igh price for meat makes marked industrial
rgentinians now pay tremendous prices (at
per animal) for prize-winning breeding stock
tle shows and turn them out to increase on the
s (ranches) and fatten on the alfalfa which is
ortant a crop in that country. The possi-
nsion of meat production in the Parana Valley
y great. Alfalfa has proved to be especially
areas and its use is spreading rapidly. It in-
to six fold the number of cattle that the land
few years ago an American, writing from his
ranch in the southern part of the province of

Cordoba[1] said, "You can buy a league (6,672 acres) for $11,000 ($1.65 per acre) and, by spending as much more in putting it into alfalfa, have a ranch that will carry 3,000 cattle and keep them practically fat all the year round with very little risk from drought or severe winters. These provinces that grow alfalfa so easily (Cordoba, Santa Fe, San Luis, and western Buenos Ayres) are the future grazing lands of the Republic. It is astonishing what large areas are taken up every year and turned into alfalfa." The four provinces mentioned have an area larger than Kansas, Nebraska, Iowa, and Ohio combined and those states cannot keep an ox on 2 1/3 acres of land. The open winter of Argentina, as of Texas, makes cattle ranching easy because barn building is unnecessary.

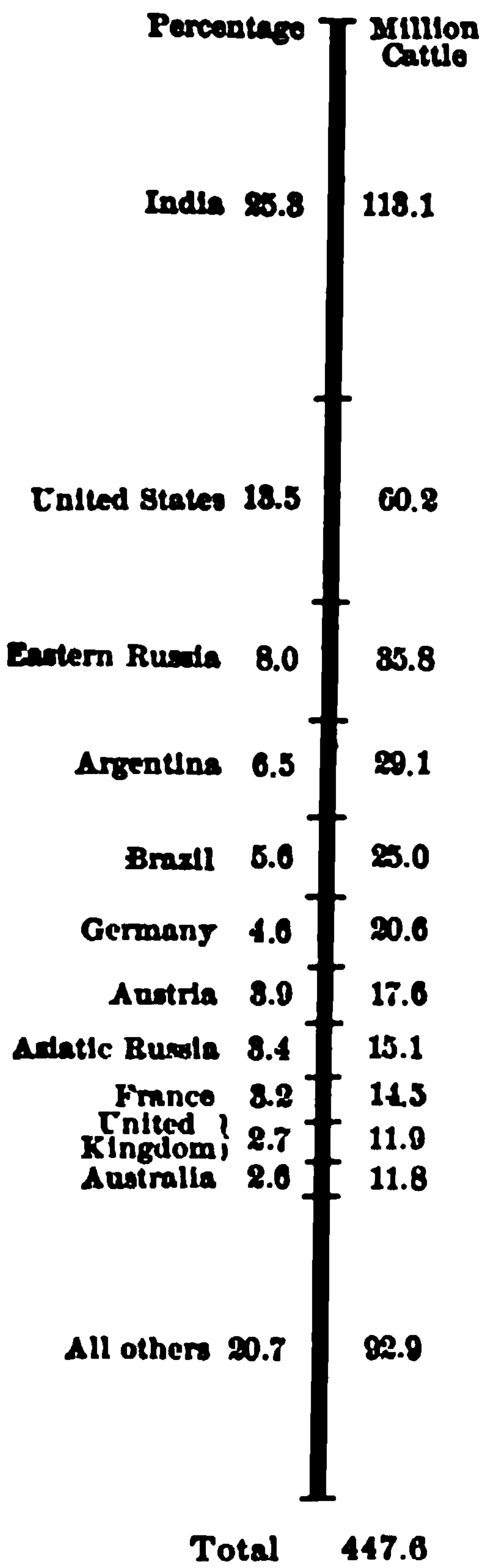


Fig. 59.—World cattle distribution, 1911.

Before the invention of refrigeration the cattle industry of the Parana (River Plate) countries had advanced beyond the shipments of hides, tallow, and bones, by the manufacture and export of Tasajo and Beef Extract. Tasajo is a peculiarly well-preserved kind of dried beef cured in the sunshine of the great pasture plains (pampas). It has the quality of keeping indefinitely in such hot humid climates as Cuba and Brazil, so that transportation becomes easy and for many years it has had a wide distribution over tropic America.

Beef extract is a convenient means of putting a big roast in a small bottle, the manufacture of it therefore being an industry that could go to the farthest corner of the globe to find cheap beef. Almost every drug store in the world keeps a well-known brand of beef extract that has for some decades been manufactured on the banks of the lower Parana from the cheap beef of Uruguay and Argentina.

[1] U. S. Department of Agriculture, Report No. 77. Alfalfa Production in Argentine, 1904.

at-packing firms from Chicago have opened
ntina and Uruguay and now compete with the
aufacturers in the purchase of fat cattle and sell
pe in competition with the product of American
e meat shipments have even been made to

Ic America.—The cattle of American countries
ine Republic and south of the United States
with international trade, but they are important
ople in the highlands of Mexico and Central
e Andean countries of Columbia, Ecuador,
ı have not the facilities to export meat even if
lus of cattle, which they do not now possess.
umbers are produced in small herds and con-
these countries. Their hides, however, are a
rtant export, since they keep indefinitely and
all conceivable abuses in transportation. In
re the export second in importance.
a has important unused resources for cattle
example, the grassy plains of the Orinoco with
periods of rainfall and sunshine. Other lands,
and Central America, produce grass the year
ell suited to cattle. Transportation difficulties
a start. It costs more to get a bullock from
to Puerto Barrios, 196 miles, than it does to
rest Kansas to Chicago. If he continues his
Orleans, the total cost is double the freight from
o New York or Boston (U. S. Con. Rep., 1911).
great numbers, they could doubtless be moved
recent beginning of the shipment of dressed
from Puerto Cabello, Venezuela, is exceed-
a much smaller way of the revolution wrought
Uruguay.
e are relatively unimportant as yet, the number
e whole continent being less than that for
raguay combined (about 12 million in 1910)
portant part of the continent, British South
as many (4 million) as Iowa. African climate
Aridity makes both north and south Africa

resemble the less favorable parts of our arid West. It is too wet and hot in much of central Africa for cattle to live at all, and the interior plateaus have not yet been settled. South Africa a few years ago was reduced to the brink of financial ruin because a fatal disease called the rinderpest swept from the Zambezi River to Cape Town, killing almost all the cattle as it went. The Boer who was dependent upon his ox cart was deprived of means of transportation, and the farmer who had been keeping cattle had to turn to some other resource. Science has now conquered the disease and the industry is returning. In Matabeleland, Rhodesia, north of the Transvaal border, a large grant of land has recently been made to a London company which is now building dipping tanks (for disinfecting live animals and removing vermin), digging wells, and stocking its ranch with cattle. Later it is planned to build a meat-extract plant. The location, as far from the Southern Sea as is Chicago from the Atlantic, and with no home market, is a natural one for the manufacture of so concentrated a product.

Cattle in Southeastern Asia.—India leads the world in cattle. She has 50 per cent more than the United States and three times as many as Russia, the third cattle country in the world. They are used for work animals as well as meat animals and, excepting hides, there is no export of importance.

In the Philippines, a somewhat similar dependence upon cattle was disturbed by rinderpest with great loss of cattle "to such an extent that the entire economic situation of the islands was endangered" (U. S. Con. Rep., Jan. 23, 1911). The same diseases are now ravaging Siam, while south China is having a lively trade in restocking the Philippines with live cattle.

4. THE FUTURE SUPPLY AND PRICE OF MEAT

The nineteenth century was a period of industrial discovery and commercial expansion by means of railways, steamboats refrigerator cars and ships. This permitted the western world to have for a few decades the cheapest meat supply we are ever likely to have. There are no more great plains to discover, and the population is increasing much faster than the numbers of

d as a result meat is to-day rising in price in rts of the world. For this there is no remedy nay not be an entirely fanciful prediction that a juicy beef steak will be the center piece able.

s that between 1902 and 1910 the wholesale reased 45 per cent at her abattoirs. Similar many have recently caused an absolute decline animals slaughtered, and that empire is now 000,000 worth of forage per year. Far-from new producing regions may be expected elief, but the great lands on the agricultural ady producing. The recently established ex- Hankow, 600 miles inland in China, to Liver- g, but not indicative of an important new It is chiefly promoted by the very low level evailing in China and the fact that her people t meat.

5. HAY

y to the Animal Industries.—Grass is the nat- of our domesticated quadrupeds. Pastures or animals can feed in summer are the commonest ican farms. Hay, the dry grass or pasture r in barns or stacks for winter use, is almost In the harvesting of this crop we see one ts of intermittent climate which stops growth. y to make hay in lands where grass will grow s it does in many parts of the torrid zone. supply crop, to be eaten by the animals of the saleable in the form of work, meat, butter, l, and hides. Practically all of the pasturing he reindeer can get along well on hay. It is o alike by the elephant whose native food is the tropical jungle, and by the camel who at nself with the bushes, the harsh grasses, and desert. The deer and the moose also like it, native homes they nourish themselves in

winter almost entirely upon the twigs and branches of bushes which project above the snow, and such forage as they can get by digging in the snow.

Hay and City Dwellers.—It may seem that this supply crop of the farm is of little value to the city dwellers, but nearly all of them are indirectly dependent upon hay. Every time one eats beef, mutton, butter, milk or cheese, he uses a commodity that could not have been produced in usable quantities but for hay, and when there is a shortage in hay, dairy products and meat are high in price. Even bread itself is usually the product of the labor of hay-fed beasts of burden, and the delivery of goods in the city itself has depended largely upon horses that could not stay a week but for their bales of hay. "All flesh is grass," says the Old Testament.

Natural Hay.—In the semi-arid regions, like the Great Plains of the central part of America, nature herself makes good hay. Here the rain comes in the early summer making the grass grow rapidly. With the increasing dryness of late summer, the grass dries and stands for months rich and nutritious. The best kind of American grass for natural hay is the so-called "buffalo grass" which for centuries has been an important part of the food of the vast herds of buffalo, antelopes, and other wild animals of the Trans-Mississippi. This natural hay, being the product of a typical climate, is to be found in the other semi-arid regions. Human life depends on this wild hay when tribes live through the long dry season as do some of the Arabs by moving with their flocks from place to place in search of pasture.[1]

Distribution of Hay Production.—The cultivated hay crop is general in the north temperate zone and also in parts of the south temperate zone, except ~~on the pasture plains above~~

[1] This great dependence upon wild hay is said to have crystallized itself into law. In the dry part of the year a fire once started in the hay will destroy it for miles. The fire itself may overtake flocks or camps and also destroy them. As there can be no more pasture until months later when the rains come again, the person who starts the fire may thus bring starvation to herds of animals and loss of human life to the people who depend upon them. As every people punishes most severely those offenses that tend to destroy society, death therefore is the penalty upon the Arab who starts a grass fire. No matter how accidentally it occurred, no matter how well meaning he may have been, no matter if it be the son of the chieftain himself, he has committed the unpardonable offense of imperiling the life of the community, and like the traitor, he must make the supreme payment—an excellent illustration of the influence of environment upon social phenomena.

nere it is rapidly increasing in irrigated sections.
ates, Canada, and Europe it is a very important
nited States it exceeds the wheat crop in value,
it in area. In value, corn of course far exceeds
netimes does. In Manchuria, Japan, and China
nportant because of the small number of animals

y to Other American Crops.—Cultivated hay is
the grasses known as clover and timothy (the
housand native American grasses[1] yet domesti-
hout large parts of the United States, and to
Europe also, the common practice is to sow the
fields of wheat, oats, rye, or barley when these
sown, or in the early spring when the freezing,
ring of the ground open little cracks to receive
grass starts in the grain and fully establishes
harvest. In America it is a common practice
er and timothy. The clover being a quick and
comes first, making a clover hay crop the year
crop. In the next year or two the timothy
of the ground so that altogether several hay
hered if the farmer so desires, before the grasses
eld is plowed for grain.

on of the Hay Crop.—In the United States
e great hay center also, a fact which shows very
producing one farm crop only are not common.
ms are frequently the original 160 acres or one-
are mile which the Government gave away to
y to seventy years ago. They are often divided
about 40 acres each, and it is not uncommon
e in corn, one to be in oats, wheat or barley,
ure for the cattle in summer, and one to be in
in winter. The cattle and hogs are fattened,
upon corn, but the horses, cattle, and sheep
ss eaters, and can no more live entirely upon
n live entirely upon meat; they must also eat
foods as hay, which is an essential part of the

e of the possibilities yet awaiting American agriculture
industry.

system of mixed farming (cattle and grain) that so commonly prevails.

Methods of Making Hay.—Methods of making hay have greatly improved through the recent invention of machinery. The mowing machine to-day cuts a swath 5, 6, or 7 feet in width as fast as the horses can walk. To let it dry out more rapidly, a horse-drawn tedder stirs it up with many kicking feet. Big rakes drawn by one or two horses pull it into heaps, or a kind

FIG. 60.—By the use of these devices alfalfa hay is gathered and thrown upon the rick without wagon or pitchfork. (U. S. Reclamation Service.)

of elevator called a hay-loader, is often attached to the wagon, to pick up the hay and put it on the top of the load. Upon reaching the barn or stack, it is lifted off, hundreds of pounds at a time, by a hay fork or sling operated by the horses. So great is the saving of labor that, in some of the alfalfa fields of the West, it is said that hay can be made at a labor cost of $1.00 per ton, making it the cheapest of animal foods, and enabling the productive alfalfa lands to bring a very high price for American farm lands.

erce.—The bulkiness of hay in proportion to
comparatively unknown in foreign commerce.
r, 50–70,000 tons per year, about ~~0.1 per cent.~~
crop, is compressed into bales of small bulk
the American corn belt to west Europe, where
r of animals required by the meat- and milk-
horse-using populations of manufacturing dis-
necessary that they shall import animal food.
times sent from Chili to England, but European
re closely restricted to the more easily trans-
concentrates.[1]
hay movement is much larger than the foreign,
nt from the corn belt to the cotton belt, where
might produce all its own forage and produce
eople are devoting themselves so exclusively to
that they frequently buy food for their work
also of considerable importance in local com-
parts of America where horses work in moun-
r forest regions, at lumbering and mining. To
o it is evident hay must be sent, so that, in the
is a large internal commerce in hay in this
nany cities of New England and the North-
make this region the greatest American hay
fore the farmers of New York and New England
hay more important to them than do the farmers
In many districts of New England it is almost
own and sold on many half-abandoned farms.
y that it is difficult to plow, but once the ground
ss and the surface stones are picked up, hay
after year, with the result that, in the New
hay is by far the most important crop grown,
and in some states than all other crops together.
op of New England is, however, much smaller
equal area of the corn belt, because of the much
n of the land that is in cultivation, and the low

le Europeans grow root crops for stock feed—mangel,
nd Rutabagas, in quantities entirely unknown in the

Hay in Irrigated Countries.—The best of all hay plants is the alfalfa, a clover which lives for many years, can slumber through months of drought, can spring into rapid growth the very day that water is applied, and can produce 5 or 6 tons of hay per season in three or four cuttings on rich irrigated land. To crown its virtues, alfalfa hay is rich, richer in protein than wheat flour. Hay, therefore, reaches its greatest importance on the irrigated districts interspersed among the arid and semi-~~arid lands of~~ the West, where alfalfa alone makes satisfactory stock raising possible. The same combination is common in ~~other arid regions,~~ such as Chili, Argentine Republic, and many parts of the Old World, alfalfa being a plant of world-wide distribution. New varieties of alfalfa recently introduced from Turkestan and Siberia are expected to be of great benefit to the Mississippi Valley.

The European Hay Crop.—As a whole, hay is more important to European animal husbandry than to the American. Europe has ~~more cattle to the square~~ mile than we have, and since cattle are rarely pastured, a larger proportion of European land is in hay. Swedish hay is so vastly important that the poor peasant must in those unfavorable climates actually spread the grass out under sheds to protect it from the rain until it dries, and then shelter it for winter use. To get it to the barn it is at times brought down from heights on trolleys, travelling on wire cables. Such laborious conditions of agriculture as this explain the emigration of Scandinavians to America, and we see why people who had been able to live in such a country quickly prosper in roomy America, with its more favorable climate and many opportunities.

To the Icelanders, hay is a necessary link in a hard existence. Wool is one of their chief money crops and to feed the sheep through their arctic winters, they literally shave their hummocky hay fields with scythes.

As east Europe resembles western America, it is Russia with its great plains and millions of cattle that furnishes the region of greatest hay production, and part of the crop finds its way to the London market in the form of ever-increasing quantities of butter which is being shipped now even from places as remote ~~as~~ central Siberia.

ıs of the Po in northern Italy where the irriga-
times rich with the mud ground by glaciers
cliffs, is turned upon the fields, it is said that
e crops of hay per year are gathered, thus
rict to export butter to less favored sections.

6. DAIRY PRODUCTS

ducts and Their Uses.—Milk, intended only for
ie particular species producing it, has been taken

ggenburg goat, Fanette, weight 135 lbs., product 2440 lbs.
of the most efficient milk producers in the world. (Photo.
dlands, Cal.)

ıs times and places from camels, mares, sheep,
even the Indian water buffalo. As a result
and improvement, the goat and the cow have
y adapted for this service and give quantities
would have astonished our primeval ancestors
icated the animals. The breeds of cattle are

of two classes—the beef animals that get fat if well fed, and the dairy or milk breeds that give much milk if well fed. The dairy products are first raw milk and then a number of manufactures of milk, chiefly cheese, butter, and condensed milk. Milk is a perfect food, in that it completely sustains life, but very dangerous because of the ease of contamination in its collection, and the further fact that it is a perfect germ culture.[1] Cheese, a con-

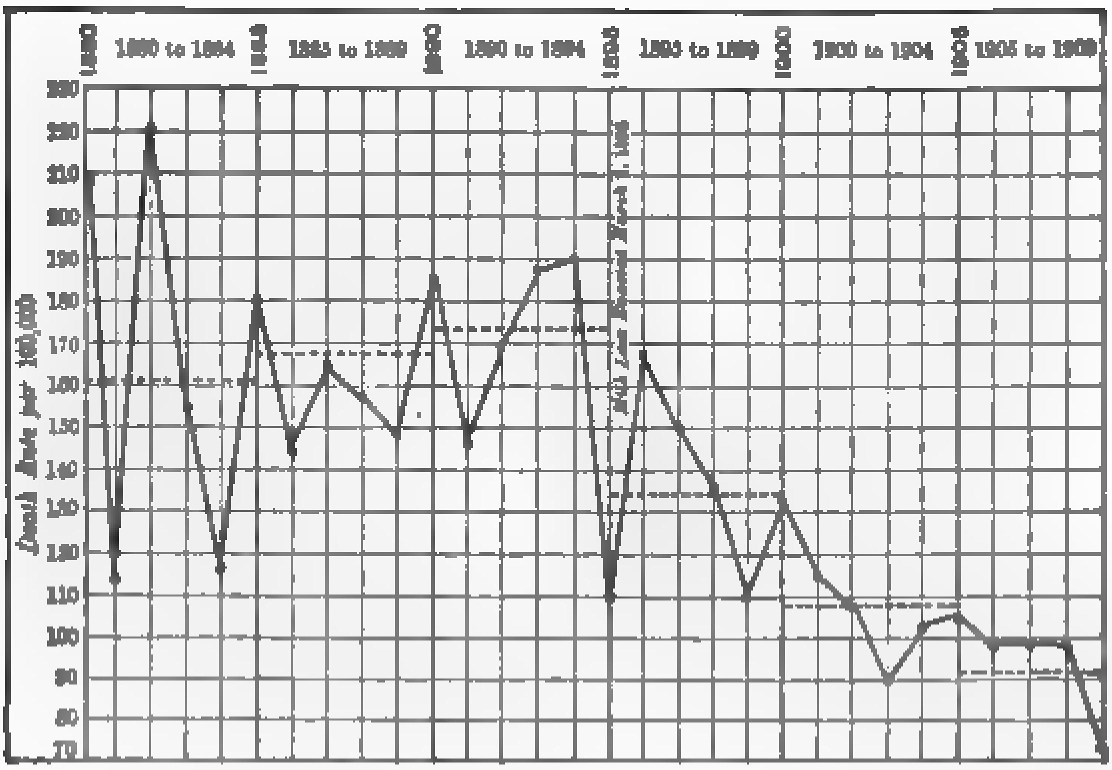


Fig. 62.—Decrease in death rate of children in District of Columbia following the enactment of the milk law of 1895. Dotted line shows average for five-year periods (four years from 1905–09). (From Brigham.) Commerce in milk has increased our dangers.

densed form of milk, is a substitute for meat (see table of food analyses); and butter is a fat, supplying well the deficiency of the albuminous and starchy foods. For this reasón it is so well liked with bread. All three of these major dairy products, especially milk and butter, are valuable in the preparation of many other articles of food.

The nomads, such as the Kirghiz, who follow their flocks across the steppes and mountains of the southern part of Asiatic Russia, probably depend more upon milk and its products than any other people. Aside from these roving herds, milk production

[1] The relationship between the condition of the milk supply and a high infant death rate is often astonishing.

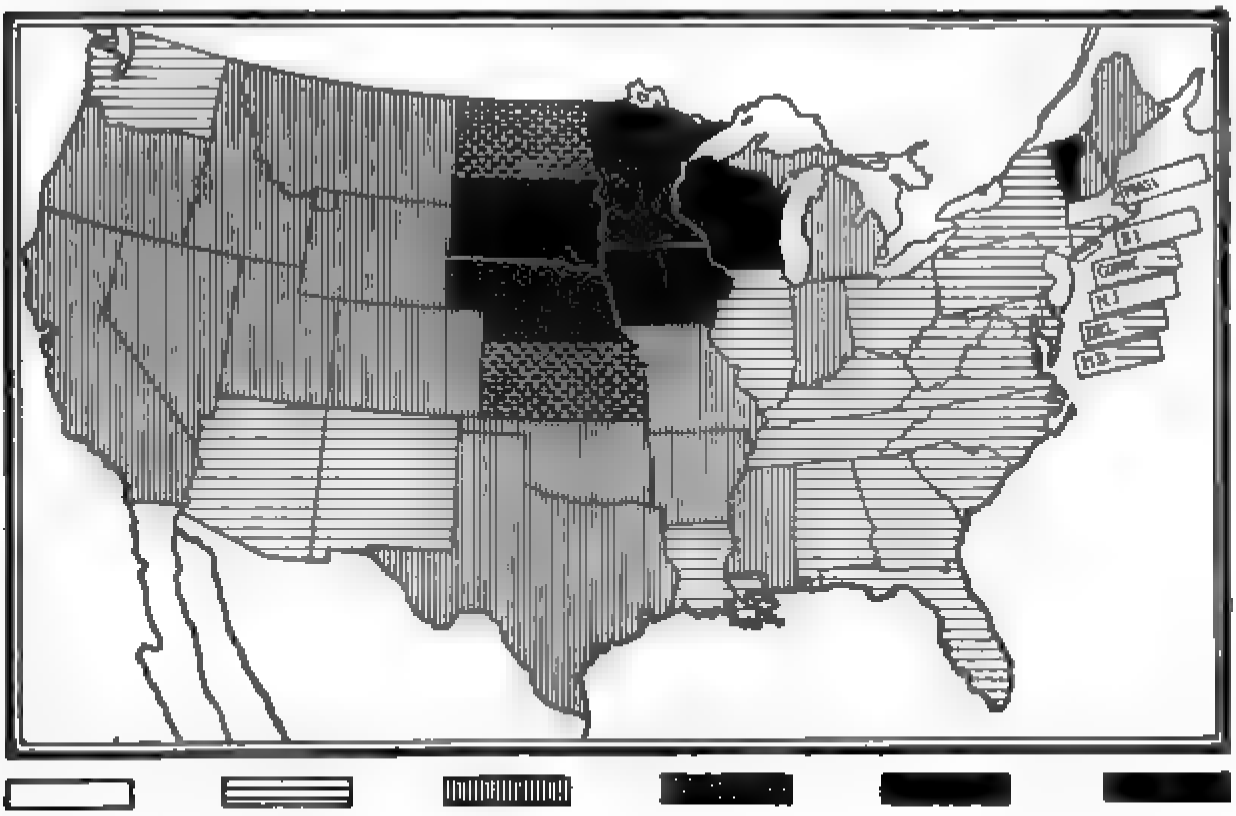
lands of little rainfall, or of summer drought, n California and the Mediterranean countries, arcity of grass. During the months of summer of supplying milk animals with green and suc- great as to make milk relatively expensive and xury.

bstitute of the Dry Sub-tropic Climate.—For- literranean climate furnishes a partial substitute oil which is chemically almost exactly like the fat places it in the diet of the people of southern sia Minor, and north Africa. It is said that ats from 20 to 25 pounds of olive oil per year, will grow on only half the area of the Kingdom. oduced about 14 pounds per capita in 1910 and rted about 10 pounds of butter per capita. In nusual yield, this Greek oil output of 25 to 30 nounted to 80 or 90 pounds per capita. Many erican cities, run by people from the Mediter- rve good meals, satisfactory to the American oil entirely in place of butter.

ntity of milk that is used, chiefly by children, in g countries of Europe is largely supplied by live on a poorer and drier diet than is possible ome varieties of milk goats in Mediterranean greater amount of milk in proportion to their consumed than does any other animal in the nore, goat's milk is richer than cow's milk in ids. One of the characteristic street scenes in s the milkman driving herds of goats through ilking them at the door of the customer, being ntee the absolute freshness and purity of the milk. territory where the olive tree and the cow com- om the eastern part of the United States, an abundant supply of milk, have moved to nia where the Mediterranean climate makes n more costly than in the moderate rainfall of The milk is expensive to produce and much t from the Mississippi Valley. Readjustment to geographic conditions is coming through

the discovery that the olive will grow there, and the growth and use of olive oil, the natural product of that climate, is increasing.

Characteristics and Location of the Dairy Industry.—Dairying as an important industry depends entirely upon cow's milk. It has arisen in lands of moderate coolness where the rainfall is sufficient to make the succulent grass and other forage required by cows giving profitable quantities of milk. Owing to the bulk weight



Less than 100 cows | 100–200 | 200–300 | 400–500 | 500–600 | over 600

FIG. 63.—Milch cows in United States per 1000 inhabitants, by states, Jan. 1, 1912. (U. S. Dept. Agr.) Pop., 1910.

and perishable nature of milk, it must be produced near to the market if it is to be consumed while fresh. The great demand for fresh milk in the vicinity of New York City has caused milk to be brought nearly 400 miles in special express trains, such as those running from Wayne Co., Pa., and from the banks of the St. Lawrence to New York City. This, however, is exceptional, and it may be said that cows and dense population go together in United States and Northwest Europe. Thus New York, our empire state, leads all other states in its number of milch cows; and Pennsylvania, second in population, ranks high in milch cows. Fortunately for the supplying of distant localities there are methods of condensation and preservation of dairy prod-

; of the milk which separates as cream can be utter and kept for weeks, or, in cold storage, for lk can be converted into white fleecy curds nto cheese which keeps for months; and, by led condensation and evaporation, along with milk can be reduced in bulk and canned so that ears. Thus, many parts of the world hitherto dairy products have, since the development of adopted their use. The West Indian planter)anish butter in Jamaica or Porto Rico, while ı to be found in the uttermost ends of the world ɔt to produce and keep milk, as in Guiana, or ape Colony, or too cold, as in Alaska, or too n Rocky Mountain mining towns, or wherever tor, or lumberman pitches his tent or builds

ements in Manufacture.—Within a few decades nts have been made in the process of manuproducts. Milk formerly required much labor ıg. It had to be set away in shallow pans for 'ore the cream could be skimmed off. Now a ıtor takes the fresh milk as it comes from the ıtrifugal force separates the cream into one .lk into another. The little hand churn of the used less and less as big, steam-driven churns tory (creamery) make more and more of the rld. Most of the cheese is now also made in han upon the farms of the people who keep er example in the long series of victories of ıome industry.

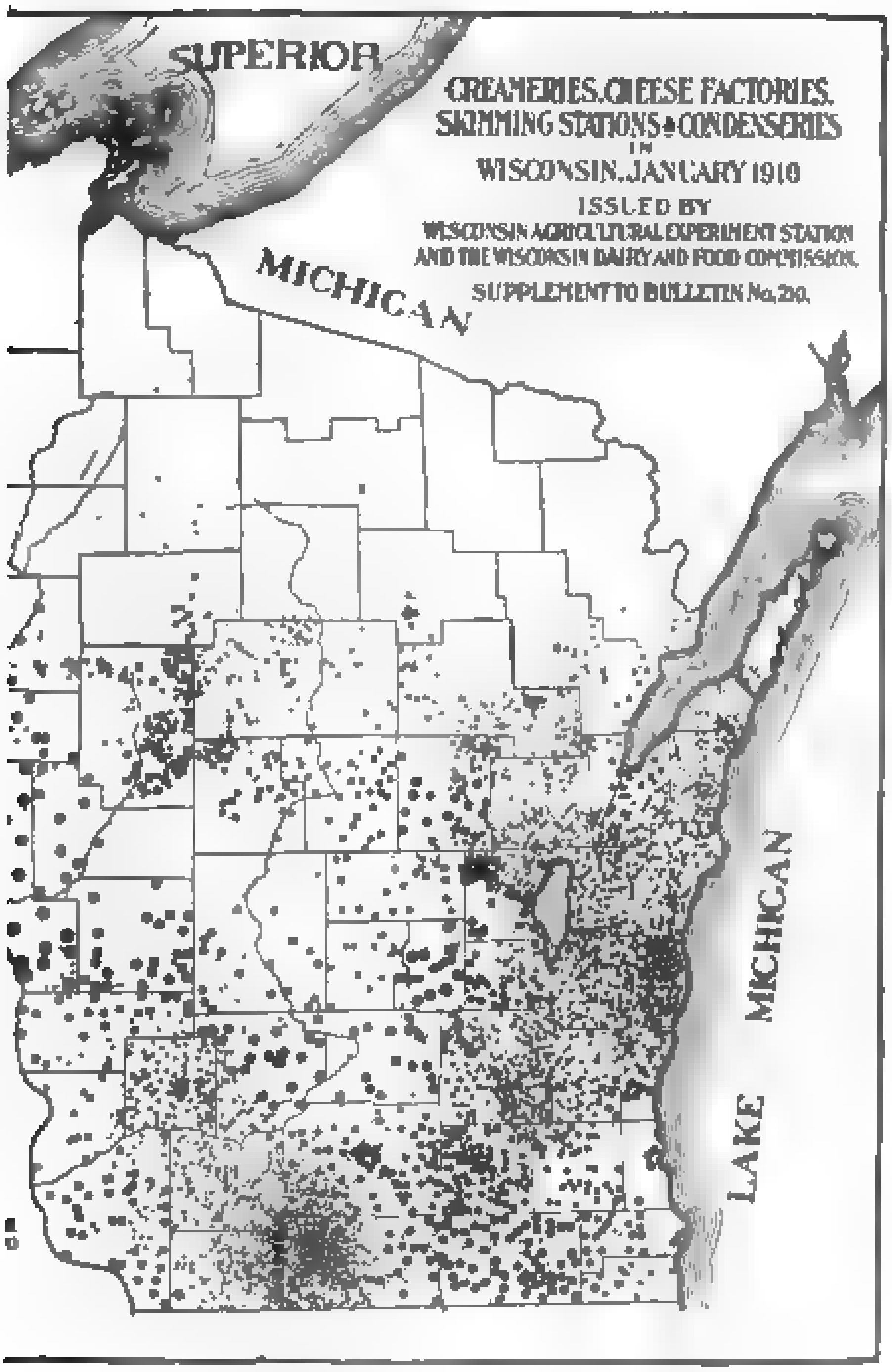
ntensification of Agriculture.—Dairying marks ge in the intensification of agriculture, which the income from a given piece of land. There which a farmer may get more product. One and, the other to put more care and labor on Where the population is sparse, little land is ɛe the food, the price of land is low and the interest on its small value by cultivating a and with a minimum amount of labor. Such

is the characteristic of new countries which are rarely dairy countries. The Great Plains of United States are an excellent illustration. There are millions of cows, but the available butter, milk, and cheese are inadequate for the use of the people. The cow with little care from her owner runs upon the great range, and the calf which drinks all of her milk may never be seen by the owner until the day he is branded or sold. The Red River Valley in Minnesota, Dakota, and Manitoba affords another example of extensive agriculture; this time in wheat. Wheat lands of low price make adequate returns with similar small labor, small expense, and low yield. In New York and other eastern states, on the other hand, the land is hilly, the farms are small, and the farmer cannot grow grain so cheaply as does his brother upon the flat lands of Dakota. His farm is so small and high priced that he cannot raise enough cattle to support him if he uses the method of the beef producer of the Plains. (See table of cattle in 1912.) But a few cows

CATTLE, JANUARY 1, 1912

	Milch cows, thousands	Other cattle, thousands
Populous East:		
New Jersey	150	68
New York	1,495	894
Pennsylvania	943	627
North Central Dairy Belt:		
Michigan	806	701
Wisconsin	1,504	1,146
Iowa	1,393	2,773
Cattle Fattening States:		
Kansas	698	1,872
Missouri	822	2,773
Texas	1,034	5,177
Range States:		
Arizona	32	741
Wyoming	35	568

'e grass, his hay, his corn fodder, and much of
y by day produce enough milk to make him a
me. Therefore, it comes about that New York
within reach leads all the other states in the



bution of an industry in a state with great variation of geographical conditions.

mber of cows and besides furnishing vast quan-
milk, also ranks high in the manufacture of
densed milk. These latter products concen-
to transport tend to come from locations some-

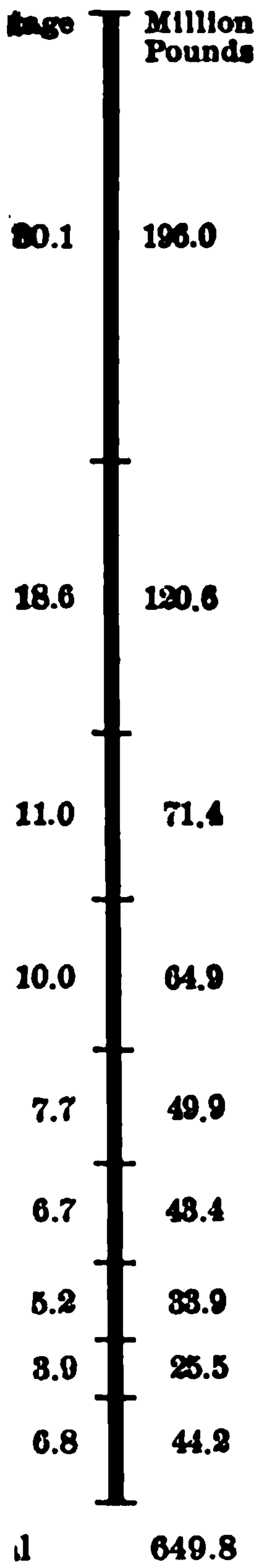
what remote from the large cities, and their production is moving westward and replacing the less intensive meat industry.

Wisconsin, next to New York, is the leading dairy state, while Iowa, Illinois, and Dakota are steadily growing. This gain of the dairy over the meat industry is a result of high land value. The values of farm lands in the North Central States have in many districts doubled in the first ten years of the century. This is partly due to the high price of corn and partly due to speculation and a land boom. The farmer there now buys an expensive farm. If he keeps cattle and sells beef, he has difficulty in earning the interest on his investment. If he sends milk to the creamery or cheese factory, the cow will each year give an equal or greater value in milk than does the bullock in meat at the end of his two or three years of life, and the meat producer eats as much as the milk producer. Thus, the greater intensity of milk production causes it to displace meat production and the table of cattle in 1912 shows an interesting and suggestive change in ratio of dairy to other cattle as we go west.

In dairying the farm becomes a kind of factory, using its own raw materials. A thousand dollars' worth of hay, corn, and bran may with little labor be turned into $1,400 worth of beef or into $2,500 worth of milk by the much greater amount of labor required in the care and daily milking of a herd of 20 or 30 cows. This often doubles or trebles the number of families living on the same farm and enables dairy districts to support a larger population than meat- or grain-selling districts. Farmers in some parts of North Dakota have been driven into the dairy business because the Canada thistle choked out the wheat crop and broke up bonanza wheat growing or one-crop farming. This proved to be an economic blessing in disguise. The farmers were compelled to rotate crops (which killed out the thistle) and, instead of wheat, to raise forage crops and then keep cows to dispose of the product. This intensification of production increased the farm income and raised land value from $15 per acre as wheat farms to $25 per acre as dairy farms.

Wisconsin and the lower peninsula of Michigan developed a dependence upon dairy products earlier and to a greater degree than the states of the corn belt proper because their land is not quite so well situated for corn, and therefore the people have been

rn earlier from grain growing and make their by other means, such as potato growing and Visconsin, the State University has, through its lture, given a conspicuous aid to the dairy in-stigations, lectures, bulletins, and class-room



export of butter, age, 1908–10.

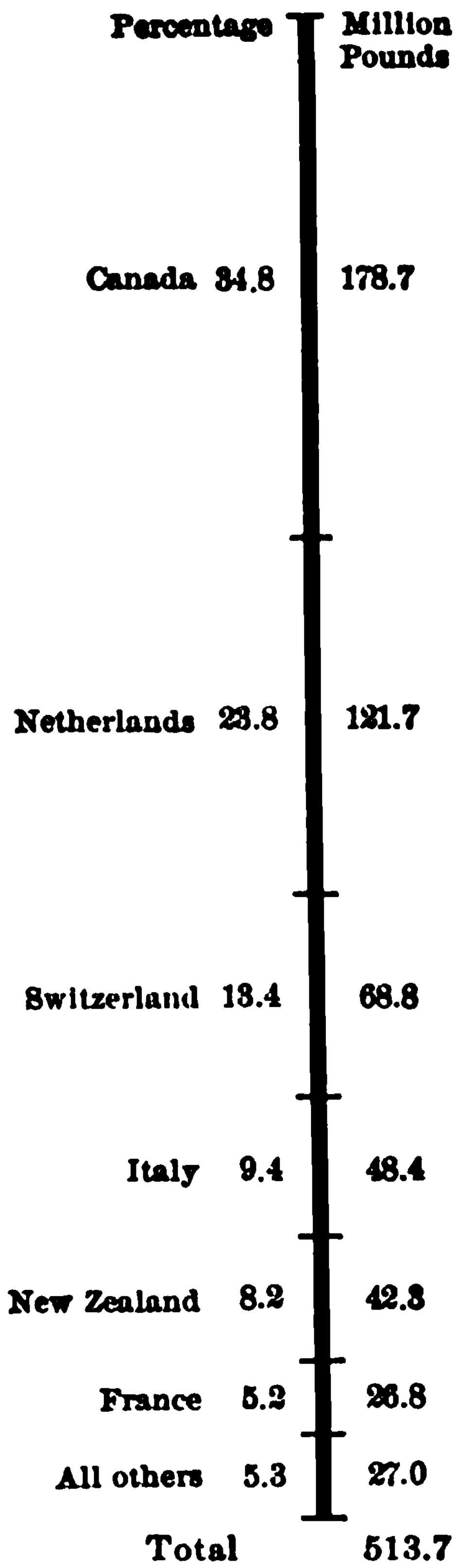


FIG. 66.—World export of cheese, three-year average, 1908–10.

us spread among farmers knowledge of the most ofitable methods of dairying, and it has been an in bringing the state toward leadership in this 909 there were 2,969 creameries and cheese

Canadian Dairying.—That part of Canada lying between Lake Huron, the city of Quebec and the American boundary, comprising the populous parts of Ontario and Quebec, is like Wisconsin and New York in its inability to compete with the level West as a grower of either corn or small grain. Consequently the people have long since turned to dairying and have reached a high degree of success. The provinces of Ontario and Quebec have more than 4,000 factories where butter and cheese, especially cheese, are manufactured. Great care is taken to maintain the high quality of the product, and it is consequently much esteemed in Great Britain, whither four-fifths of the cheese goes, making up half of the British import of that article. Canadian competition, together with inferior quality and bad repute of American cheese, has greatly lessened the export of the American product.

INTERNATIONAL TRADE IN DAIRY PRODUCTS (1910)

Exports			Imports		
Country	Butter, million pounds	Cheese, million pounds	Country	Butter, million pounds	Cheese, million pounds
Argentina	6		Argentina		9
Australia	88		Belgium	13	31
New Zealand	73	51	Austria Hungary		13
Canada	4	181	Brazil	5	3
Denmark	195		British S. Africa	4	5
Finland	25		France	11	49
Russia	124	5	Germany	93	46
France	54	30	Italy		15
Holland	73	122	Switzerland	11	6
Italy	8	57	United Kingdom	477	268
Sweden	48		United States		44
Switzerland		69			
United States	3	3			

The fact that dairying is an industry of intensive agriculture to which America has not largely attained is shown by the in-

net absence) of our exports in comparison to
s Sweden, Holland, and Denmark.

Northwestern Europe.—Northwestern Europe
oil, cool humid climate, and dense population,
ement for a great dairy region and the scarcity
heese to be used far more than in meat-eating
hundred and forty-two kinds of cheese, most of
are recorded in a U. S. Department of Agri-
The European demand for cheese and butter
Canada and other parts of the world must
enormous home production. England and
smaller than Missouri, but with a population
it of the United States—consume in fresh form
e milk that can be produced at home. Ireland,
d, with a sparser population and a better grass
of the moister climate, is too far away to send
, but sends large quantities of butter to help
demands of the English people with whom
is an important article of diet. Consequently
rt more butter and cheese than any other half
e table of international trade in dairy products).
urce of supply is the great continental dairy
hes along the northern plain of Europe from
to Denmark, Sweden, and Russia. Through-
elt the farms are small, and the rural popula-
d while grain-growing is practised on most of
eping of dairy cows is also exceedingly common.
France makes much excellent butter that
capitals of London and Paris. The Channel
England and France, with daily steamers to
long been important dairy centers that each
, Jersey, and Guernsey, has given its name to a
cattle now widely scattered throughout the
n of Camembert in Normandy has given its
own brand of cheese and in the south of France
Roquefort, where for generations the peasants
rn from father to son the art of making from
famous cheese which is ripened in stone caverns
round.

Holland has been famed for its cattle since the days of Julius Caesar. Meadows, which the Dutchman has won from the sea by pumping out the water, are made of the rich mud that the Rhine has brought down from the fertile highlands of central Europe. These moist, rich lands, too wet for tillage, make pastures of great richness. Here drainage ditches separate from each other the little green fields, dotted with feed boxes from which the black and white cows eat bran and grains imported from America. By this means farmers increase the number of cows they can keep. In damp and cloudy weather the cows are blanketed in the pastures (U. S. Con. Rep., Jan. 16, 1911). These richly fed and carefully tended herds of the well-known Frisian or Holstein breed give vast quantities of milk which makes dairy products the chief of all the farm products of well-tilled little Holland. The Dutch make 24 pounds of butter per capita per year. This is several pounds more than we make in the United States, but the Dutch being poorer eat less of it per capita than we do. Their cheese output exceeds that of butter. The town of Edam, west of the Zuyder Zee, has given its name to a kind of cheese produced largely in that part of Holland, and, along with other Dutch brands, it goes to England, to the United States, and even to South Africa and many other countries where the fame of Dutch cheeses has spread. Sweet butter also goes in large quantities to England, but in the production of this commodity Denmark is the teacher of the world.

That little country, about half the size of Maine, is visited by the agricultural scientists of all the world who would learn in its best form the art of dairying. Forty years ago she was a meat exporter to Great Britain, but the demand for more products has turned this democratic kingdom into a vast dairy farm. The Danish peasant owns a farm of from five to twenty-five acres. The land is usually sandy and was originally infertile but has become rich by good care and imported fertility in the form of cow foods. More than half of the surface of the land tilled is in oats, hay, grass, and root crops to feed the cows. The increase of land used for forage has encroached upon the grain fields until there is not wheat land enough for bread. The harvest of 1910 was valued at 147 million dollars: of this 44 million was root crops (largely cattle food) and 62 million grain (largely

for cattle). There is in addition considerable
nd grain products from America and Argentine
their cows. As a result, Denmark with a poorer
nd in having more farm animals for its area
country of the world; there are more than a
es for making butter; the cows are inspected
insure healthy stock; and the dread disease of
common among housed cattle of the entire
ntirely stamped out of the kingdom of Denmark.
) worth of butter is sent each year to Great
'he price received for his product by the Danish
ess than that received by the British farmer,
to the city populations near at hand. This
e for milk for the two purposes is common in
cts. Through careful catering to the demands
'anish butter preserved in tin cans has become
icle for consumption in the tropics and in all
rs of the globe where there is no local supply.
arts of Sweden, which are not far from Denmark,
y learned the art of making good butter; and
ch in 1870 was a butter importer, is rapidly
tter exports to Great Britain, over $6,000,000
ed there annually.

of European Dairy Farming.—Dairying is also
very large extent in northern and western Ger-
arge population consumes the entire product
hat dairying here, as in France and other north-
ntries, is carried on in its most intensive
ws kept in barns and food brought to them.
istrict near Cologne, farm lands are worth $400
(U. S. Con. Rep., May 12, 1911).

s an interesting and unique dairy industry.
reas of land upon the high mountains, habit-
nmer, produce an abundance of rich grass
now recedes and lets sunshine upon the satu-
villagers of the valleys take their herds of cows
tures in summer and, because of the distance,
hrough the whole season, spending the nights
have been built for the purpose. At intervals

members of their families bring up the necessary supplies and take away the accumulations of cheese and butter which the herders have produced. On the lower slopes of the Alps the water from snow field and glacier is often conducted out over the fields to fertilize and irrigate the grass for winter hay. As a result of this careful industry, Switzerland is an exporter of

FIG. 67.—Italian woman carrying fresh grass from field to farm animals—a common scene in densely peopled lands.

good cheese, Neufchatel being one of the best-known brands. She also sells nearly $2 per capita per year of condensed milk, some of it going to Canada, England, and India. Milk is also an important factor in the manufacture of milk-chocolate, in which Switzerland (like Holland) is important, sending abroad annually about three-fourths of the total product, valued at $10,000,000.

me to the land of summer drought where com-
is in the main limited to the irrigated lands of
The Alpine streams furnish water for the
es and hay crops which are responsible for the
talian cheeses that are well known in many
world. One of these, the Parmesan cheese, is
ilk. Cheaper cheeses are imported into Italy
people just as the Dutch and Danes import
rom Chicago for their own use and sell the
make. Oleomargarine, a butter substitute, has
me chemical analysis as butter. Being made
(body fat of beef) the possibilities of cleanliness
re ahead of those in butter. The opposition to
m the fact that it is sold at a fictitious value
ne.

n of dairy exports (see table) from the United
h, and agricultural—and from mountainous
le Switzerland, with half her used land in hay,
n absolute quantities (U. S. Con. Rep., July 8,
er capita basis, Swiss cheese and milk exports
re exports of the United States in grain and
nimals and animal products. Thus the Schweit-
e, makes the most of his limited opportunities
n, with more resources, does not have to refine
It is evident that commercial dairying depends
stribution of laborers (density of agricultural
on resources—another example of production in
t fitted for it. In dairy possibilities America
urope.

test superiority over Europe as a place for the
iry products is the priceless boon of corn, the
ps for which the people of all European dairy
bstitute the laboriously produced beets and
nd the less productive barley. The American
en better dairy possibilities than the corn belt,
m glaciated Wisconsin.

d Refrigeration.—The refrigerator ship which
d the meat supply has made possible the
tter and cheese from the most remote countries.

Thus New Zealand, which is almost exactly on the opposite side of the world from Great Britain, has become an important source of supply. That country, nearly as large as Italy, has a splendid rainfall owing to the prevalence of the constant west winds, from off the great southern seas. The Government has taken great pains to inspect and guarantee the quality of exports with the result that New Zealand butter and cheese stand well in European markets. In 1910, 85 million dollars of exports out of a total of 110 million were animal products, chiefly wool, meat, butter, cheese and skins, while other agricultural products were but 3 per cent. as valuable. Australia, being further north, and out of the latitude of steady rains, has her production of dairy products sadly interfered with by the droughts. Consequently the industry, less important than in New Zealand, is chiefly limited to Victoria, the most southerly, the coolest, and rainiest part of a warm dry continent.

The Argentine Republic.—The Argentine Republic shows by its enormous exports of cattle and beef that it might also produce milk and other dairy products, but thus far the industry has made but a small beginning. There are several reasons for this condition. One is that it takes great care to make good butter and cheese in a warm climate. The sparse population of this new country does not furnish the labor which such intensity of agriculture as dairying demands, and the labor supply in Argentina has not yet developed a propensity for that class of work.

Dairying of all the great agricultural industries is the most exacting in its labor requirements. The cow must be milked morning and evening the year around; she must be treated gently; the product and utensils must be kept clean. These qualities have been developed chiefly in connection with the keeping of cattle by the Teutonic peoples from north Europe. The Spanish and Italians who make up the bulk of the population of the Argentine Republic have not had the ancestral training at keeping cattle, but doubtless they can create a new source of dairy products in the southern hemisphere, because the steadily rising price indicates that new sources of supply are needed and Argentina has the resources.

Possible Extension of Dairy Areas.—The keeping of milk prod-

or cold spring water is so difficult that people
climates were virtually unable to make good
before the recent improvements in dairy ma-
ficial cooling. Now that the steam engine can
cold room anywhere, the tropics or the cotton
States can, so fai as climate is concerned, compete
ing with Wisconsin or Switzerland. It requires
of cows, 200 to 500, to support a creamery with
achment. This number is, however, merely
er for a modern creamery and the way is now
graphic extension of dairying. At the present
dustry unnecessarily restricted to the cooler
rld. It may become common for the warm
a exceptional, as is the present export of goat
green island of Sokotra across the straits to the
Arabia (U. S. Con. Rep., July 16, 1911).
of China and Japan dairying is almost unknown
evident in the section on meat and cattle.

7. DAIRY SUBSTITUTES

relopment in the direction of dairy foods has
ecause of the heat. For foods of similar sort
land of great promise if we content ourselves
for the production of which it is after all prob-
l than for the production of dairy products
ter and cheese are but digestible fat and pro-
food analysis). Many vegetable oils furnish
nd there are many cheaper proteins than that
oil of the olive has been an age-long peer of
eed oil is now used as a substitute for olive
l for pork fat, and its use has spread so rapidly
years its price increased fourfold despite a
Even more promising rivals for dairy prod-
the oily cocoanut and the nutritious peanut.
-used plant products have recently made a

es consul at Stavanger, Norway, says that nine-tenths
oleomargarine instead of butter. The butter price is
pound and the cotton-seed oil for the margarine costs
ents with a rapidly increasing import.

late start on a career of usefulness that is exceedingly suggestive and carries the possibility of a partial revolution in food supply and production.

Nearly half of the meat of the coconut is fat or oil, and the nut has the quality unusual among oily vegetables of keeping for many months without becoming rancid. The recent rise in the price of animals has caused the price of lard to nearly double, made its substitute, cotton-seed oil, advance in price, and caused increased attention to be given to the coconut as a source of food fat. A firm in Mannheim, Germany (U. S. Con. Rep., Feb. 15, 1909; Jan. 14, 1910), has put upon the market "Palmira," a hard snow-white vegetable cooking fat made from coprah (dried coconut meats) and practically 100 per cent. pure fat. None of the rival animal fats (margarine, butter, lard, goose grease, etc.) contains less than 7 to 10 per cent. of water. "The product has found such favor that the product can scarcely keep up with the demand" and the output of the factory increased in a few years from 700,000 to over 21 million pounds per year. To make it spread like table butter, small quantities of egg-yolk and water are worked in, this product being called "Palmona."

In Austria, Holland, and England the same substitution is taking place. Coconuts are imported through Hamburg and taken in boatloads up the Elbe to Bohemia, where the oil is pressed out and mixed with a small proportion of egg-yolk and cream and sold for fourteen cents per pound in competition with butter at from thirty-one cents to forty-one cents per pound. It is difficult to estimate the importance of such a food supply to a population whose adult laborers get from forty to seventy-five cents per day. The output of European margarine factories using coconut oil as a base is put at 16 million pounds per week, an amount that already exceeds the total European import of butter (U. S. Con. Rep., May 4, 1912). Owing to these facts "the market price of coconut oil has increased enormously and the world is being searched for additional supplies of coconuts" (U. S. Con. Rep., Sept. 25, 1910; Jan. 14, 1911). The world will have little difficulty in finding the coconuts. It can find them much more easily than it can find more butter because of the great extent of

nearly all tropic continents and islands suited
palm and the ease of producing a product that
tree and lies for weeks embedded in its thick
waiting to be picked up. In some places, ten
ual average per tree; 4,000 to 7,000 nuts make
now worth $120 per ton and yielding 100 gallons
the four years, 1906–09, the Philippine Islands
0 tons of coprah; the rapidly increasing output
element in the economic life of the islands,
se of becoming more important there and else-
e Liverpool firm is investing $5,000,000 in west
plantations.

may be considered as a partner of the coconut
e onslaught on the animal industries. While
substitute for butter and other fats, the peanut
n table of food values) is a substitute for butter,
at. Taken together, these two nuts form an
le of the shift from animals to plants as source
(a step toward easy support of larger popula-
shift of support from cool to warmer lands.

o little appreciated in the past, is really one of
nt of foods, when judged by its nutrition value.
nutritious as cheese, contains per pound more
ound of sirloin steak, plus more carbohydrate
potatoes, plus one-third as much fat as a pound
luding shells it has more nourishment than
n steak and a pound of white bread combined.
d now costs five or six cents per pound by the
out deterioration for years—in strong contrast
s and meat.

are in a period when rising prices force us to
w supplies it is not surprising to find the peanut
r diet in many ways. In Europe its chief use
edible oil wholesaling at eight cents per pound
or lard, butter and olive oil, for which it is
rized substitute. The nut also is coming into
rious forms. The fact that the plant is at home
7° north, clear into the south temperate zone
ange of soil and climate and great possibilities

of production when compared to any of the staples thus far discussed.

It has long been an important money crop in that part of the sandy Atlantic plain lying near the Virginia-North Carolina boundary. It is grown in Argentina, Brazil and Costa Rica. It is the chief export of the French and English colonies of Senegal and Gambia in west Africa, and is also exported from Madagascar, east Africa, India, Japan, and China, both north and south, It is one of the few products that is produced and exported by the white, black, yellow, and brown races.[1] The total product of the United States reaches 12 million bushels; the import, despite duty against it, is one-fifth of a pound per person (1911), and the American growers have been complaining bitterly of the competition of their Indian rivals. The export of peanuts ($6,500,000) from Madras in 1910 was more valuable than the wheat exports during the same year from any port in United States except New York.

As population, land values, and cost of living steadily rise in the cool temperate zone, the pressure comes most keenly on the animal products because of the large amounts of land required by the animals. It is a decidedly comforting thought to recognize such satisfactory substitutes in the palm and peanut which so nearly furnish diet equivalents and are so well suited to the vast areas of the fruitful tropics and to growth by the native populations already inhabiting those lands.

These two plants are merely members of a class. The soy bean, so promising in American agriculture, has 18 per cent. oil, which has long been an important fat food for the Japanese. At $1.50 per bushel, the American price (1912), the 10 pounds of oil is far cheaper than butter. The sunflower seed has 30 per cent. of oil, also edible, and from Nigeria some reports of vast amounts of oily nuts of the shea tree which promptly begin to be exported by thousands of tons as soon as the railways open up new districts. This is prized as a butter material by the people of the interior, as is the palm nut of the coasts, and like it promises quickly to enter commerce. In Sierra Leone, palm-nut ship-

[1] Being able to wait long for rain and grow when it comes the peanut has sprung into sudden usefulness in the semi-arid districts of the Mississippi Valley. The fact that it can be harvested by the pigs adds to its importance.

ubled in five years and furnish two-thirds of the $5,000,000. The fact that we get all these pro-he care of the intervening beast as in butter and it importance in considering the food possibilities.

IEEP AND OTHER WOOL BEARERS

r thought that our ancestors found the sheep upon of central Asia, a mottled animal of black, own, whose pelt has made us the best of all nst the cold and aided our advance into the land now. To this day millions of Asiatics in the continent protect themselves from the bitterness sheepskin coats and caps, and history contains ne origin of cloth making, so remote was its

s before the coming of cheap cotton (about 1800) textiles), woolen cloth was the chief clothing e temperate zone, and sheep were much more t than they now are. In the springtime their ere shorn to serve their masters the next year, had been prized long before it was prescribed as an offering to Diety.

ament shows that sheep were of great importance it the eastern end of the Mediterranean Sea and ttle less important to the early Greeks, Romans, ans who overwhelmed the Roman Empire.

ng in Britain.—For several centuries both before discovery of America the export of wool from ne great basis of foreign trade in that country. tion gave it security from foreign invasions, and e internal order which is necessary for the satis-ment of sheep flocks. People may return from neir cattle, but sheep, weak, defenseless, stupid, se, the easy prey to accident, dogs, and thieves, care. Thus it came about that England, the country of Europe, had a relative monopoly in is developed most of the important breeds of n pastures are among the best in Europe.

The names of the breeds show their British origin—as Lincoln, Dorset, Southdowns, Hampshiredowns, Oxforddowns, Leicestershire, and Highland sheep. The judges of the highest English court have for centuries sat upon a wool sack—symbol of the commercial importance of that commodity. The best breed of sheep for wool production, however, is the merino, a breed

Fig. 68.—By artificial selection for one quality some strains of Merino sheep have become racks for wrinkly skins, and every wrinkle covered with fine wool until the sheep is almost blinded by it.

developed on the high plateau of Spain from sheep whose ancestors originally came from Africa. This sheep, famed for its wool, was jealously guarded by the Spanish and for centuries they would not let any of them leave their country, but during the eighteenth century they spread to Germany, France, England, and America.

Factors Affecting the Distribution of Sheep Industry.—Before the beginning of the railway epoch, sheep were distributed upon

ırope and America, and most countries were
rting with regard to supplies of wool and mutton.
world settlement and world commerce following
teamship about 1850 led to an entire revolution
wool situation of the world. A sheep industry
ıale that has ever been or is ever likely to be
ım the throwing open of large areas of land in
ı America, Africa, Australia, and central Asia
est used as sheep ranges.

use of mountain ancestry, the sheep is a good
h pastures, and a good traveller. He can go
ad water or to market. His sharp nose enables
ı the crannies of rocks for scanty herbage. Al-
ell fitted for the utilization of land not fit for
gions with greatest dependence upon sheep are
e earth's surface which for some reason are not
r cultivation. It may be that the land is too
t, as in the Scotch Highlands with their heavy
ls would naturally be covered with luxuriant
entirely barren of trees because for centuries
ɜ forests and ate every young tree that came
when the old trees died, the land was left for
ː upon which the sheep flocks have in some cases
'eral centuries. Similarly, certain hills in the
bear to this day the names of forests, although
ıtions they have been treeless pasture lands
ːp flocks. Thus, Cotswold (meaning wood)
ve their name to a breed of sheep.

ɔowever, is the greatest reason why land is
rage of sheep rather than to cultivation in grain

.teaus of dry Spain have been famous for
imes of Hannibal and of Cæsar, and, although
merino breed originated there, most of the
re those yielding coarse wool. The greatest
ld are upon such semi-arid plains in Australia,
vestern United States, yet the fact that some
re hot, and do not naturally suit the sheep,
ation of an industry in a place that is not best

suited to it. The sheep with his warm coat is equipped for cold climates; the fleece degenerates in hot lands, the wool entirely disappearing in Cuba and Brazil, leaving only the hair coat of which all sheep possess a little. In Australia, the tendency to degeneration because of heat has been overcome by the constant importation of fresh breeding stock from England, Vermont and other localities where the sheep is at his best.

NUMBERS OF SHEEP (1911)
(*From Year-book of Agriculture*, 1911).

	Millions
Semi-arid countries:	
Australia	92.4
Brit. South Africa	30.7
Algeria	9.
Spain	15.1
Italy	11.2
Greece	4.6
Turkey	6.9
Asiatic Turkey	45.
Asiatic Russia	38.
Chile	3.6
Mexico	3.4
Countries partly semi-arid:	
United States	52.8
Argentina	67.2
Russia	47.
Countries of scanty population, good rainfall and remote from markets:	
Uruguay	26.3
New Zealand	24.
Countries with highly developed agriculture:	
France	17.1
Germany	7.7
United Kingdom	30.5
Belgium	.2
Denmark	.7
Switzerland	.2
Total of the World	615.2

Value of Sheep to Regions Remote from Markets.—A third reason why land may be devoted only to sheep is its inaccessibility for the marketing of the heavy and less valuable products of agriculture in which transportation costs must be

Grain requires a railroad close at hand. Cattle, at can be marketed, have nothing to yield but allow which is relatively of less value than the nd tallow of sheep. Consequently, sheep flocks of remote plains the greatest possible cash in- opening of new lands between 1850 and 1890 nous increase in the number of sheep throughout l.

l Islands afford an excellent illustration of the to the people of a remote land. This group of han half as large as Maryland, is located in the Ocean opposite Cape Horn in a latitude corre- thern Alaska and Scotland. The rainfall of the but the climate is cool and there is no tillage be- iling westerly winds of that latitude blow so hard cannot live because they are blown out of the hese windy plains and hills produce good grass and 0 inhabitants who give Falkland a population of erson per square mile, owns, on the average, one tle, and 300 sheep. The non-perishable wool, v, of the sheep, comprising practically the entire slands, enable the people to command the goods d, to become well educated, and to receive a an the people of any other land. It requires a ulation to utilize the land in this way and as a le are so scattered upon their large sheep ranches school masters must travel from ranch to ranch ildren in their homes. The Islands of Faroe and ilar but northern latitudes also have a similar n the export of sheep products.

f Sheep in South Temperate Zone.—The south with its large plains in South America, South ia, and New Zealand, is the part of the world atest dependence upon sheep. This zone, with per cent. of the world's people, has about 40 per ep. Taking the world over, there is about one d two-thirds persons, but in the south temperate mbines the qualities of remoteness, semi-aridity, pulation, there are ten sheep per person.

Upon the plains of these countries as upon other great sheep-growing plains, there is a special method of caring for the sheep. Owing to the defenseless character of these stupid animals they require constant care and may not be allowed to shift for themselves as do cattle. In all regions of large sheep production the method of caring for them is much the same. The herder with a couple of dogs takes a flock of two or three thousand sheep and follows them for days and weeks, being met at appointed places by supply wagons sent out by his employer. The sheep dogs, with the inherited qualities of many generations, are much more skillful helpers in driving them than men could be, and the herder's rifle protects from wolves, foxes, and dogs, while the flocks are commonly put into corrals or fenced enclosures at night.

Australia has long been known as the greatest of sheep countries and the leader of wool exporters. That continent, which is about as large as the United States, has a mountain barrier parallel to the eastern coast which shuts off from the interior most of the rain brought by the southeast trade winds. The narrow plain along the coast is good for corn and other agricultural crops requiring moisture, but west of the mountains the wide expanses of plain that slope gently away from the sea have too little rainfall for the cultivation of crops but enough to produce good grass. Some of the finest sheep ranges in the world lie between these mountains and the grassless desert which occupies the central and western part of the continent. The railroads that connect the ranches with the eastern ports reach almost to the desert and all the land that has any value has for some decades been occupied by the sheep flocks. Australia is unfortunate in the arid nature of much of her territory and also in the irregular character of the rainfall. Droughts sometimes last for long periods, cutting off both grass and water so that the sheep starve by millions, as in the period 1894 to 1898 when continued drought reduced the sheep flocks from 110 million to 84 million. The great dependence of the flocks upon rainfall and rainfall fluctuations is shown by the observations of a scientist[1] who says that with 10 inches of rainfall per year, an Australian plain will support ten sheep per square mile; with 13 inches of rain, twenty sheep; and with

[1] See Hann: *Hand-book of Climatology*, translated by Ward.

n, seventy sheep. With less than 10 inches of
l is of no value even for pasturage.
Vales possesses more than half the sheep of Aus-
eensland, farther north (nearer the torrid zone)
nd heat and better forage, and, therefore, a pre-
ttle over sheep, since they can stand heat and
than sheep, and require better pasture. South
Vales is Victoria which lies far enough from the
the region of prevailing westerly winds and gets
New South Wales, and has better pastures but
r as many sheep. Because of the superiority of
sture in a *cool* climate the farmers have enough
ows and make butter, of which much more is
s exported from the United States (see table of
. The market for the butter, as for the frozen
and and frozen mutton of New South Wales, is
in the mother country, Great Britain. The
dely distributed, but a large part of it also goes
ingdom.
—New Zealand, further south than Australia,
infall of the prevailing westerlies, is an excellent
nd is largely given over to that industry.
ountain pastures upon the western coast of New
ret from exposure to the sea winds, have such
at they will support five sheep per acre through-
These mountains make the eastern side of that
l thus cause the Canterbury plain on the east,
of arable land on the islands, to be largely used
ng; but owing to the sparse population, less than
in a good grazing territory as large as New York,
Pennsylvania, agriculture cannot be very much
he 23 million sheep and 2 million cattle are the
the country. There are 5,000 ranches of over
and the newness of the country is shown by the
en the years 1891 and 1901 the occupied land
20 to 27 million acres, and the latter figure is
e total area. The good pasture and regular food
ealand causes the frozen mutton of that country
l the best that is imported into England. The

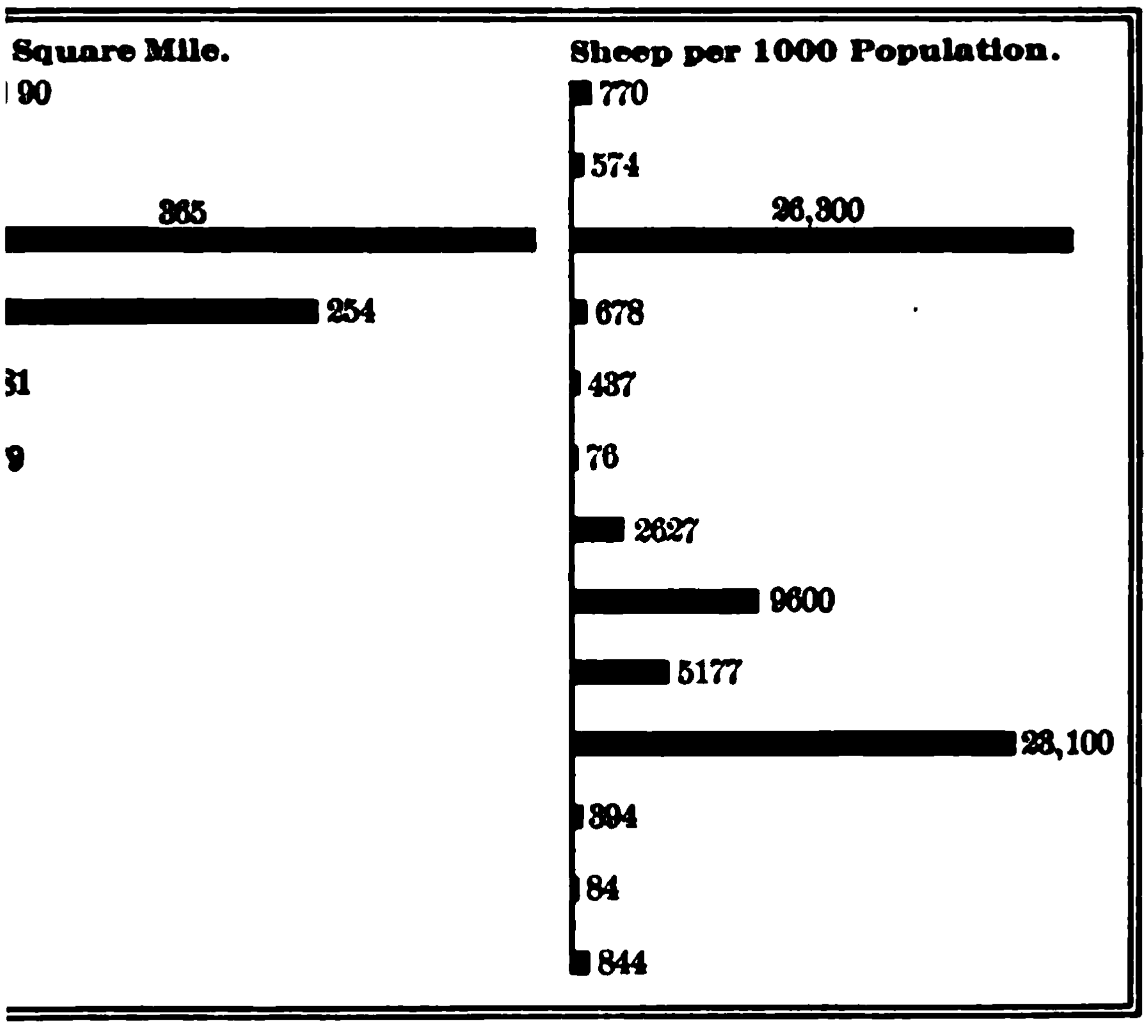
sheep are often fattened by being turned into large fields of turnips from which they first eat the tops and then the entire root, and it is said that mutton can be produced at a cost of three cents a pound.

Argentina and Uruguay.—The sheep district that most closely resembles Australia in character and rivals it in importance is the La Plata (the English call it Plate) or Parana Valley of South America comprising the most of the Argentine Republic and the little country of Uruguay. Here, as in interior Australia and in western United States, is a level plain of vast extent. For hundreds of miles it seems as level as the sea. One railroad runs westward on a perfectly straight line for 278 miles, a distance greater than from New York to Washington. Near the Parana River, the rainfall is sufficient for the growth of corn, wheat and flax, but as the distance from the river increases, the rainfall decreases, and, as in the region beyond the Missouri River, a corn belt is followed by a wheat belt and the zone of farm lands is succeeded by a zone of ranch lands in which the industrial future must, like the present and the past, be devoted to roving flocks. Forty or fifty years ago, when there was a great demand for haircloth, herds of horses valued at $2.50 each were driven into pens twice a year by their owners to have their manes and tails clipped to furnish horse hair for the crinoline looms in England and France. Then came the merino sheep, whose wool and tallow, skin and bone also went to Europe, while his meat was thrown away because there was no possible market for it. Then came the refrigerator ship and the export of mutton. The pastures of the Parana Valley are so fine that the sheep fatten entirely on grass, which is uncommon.

It is interesting that the present vast sheep flocks of Argentina are very largely owned and cared for by English and Scotch people, who for many generations in their own countries have been thoroughly acquainted with sheep and know their ills, their wants and their ways. The cattle, requiring less care, are usually owned by the people of Spanish descent and cared for by the Guacho or half-breed Indian-Spanish cowboy of that country.

In northern Argentina, the greater heat and rainfall make cattle more important than sheep, and toward the cold south the plains of Patagonia, a little known region, are being rapidly

ep ranges, often by young men of British stock nd Islands who are accustomed to sheep herding cold plains. Sheep farms have been established island of Terra del Fuego, at the extreme end of the sheep being better able to live in this country their wool protects them from the severity of will scratch away the snow to get at the grass it, and, if necessary, they can fast for several now lies too deep.



of sheep to land and to population, in leading countries.

ss the Parana River, from the best part of the lic, is from end to end an undulating grassy e a few grain growers near Montevideo, the ty-five times as much land is devoted to sheep ires. The number of sheep doubled between d their products make up the great bulk of the untry.

-South Africa is the third among wool-exporting ustralia, this region has mountains near the off the southeast trade winds from the interior, plain near the sea for agriculture and cattle

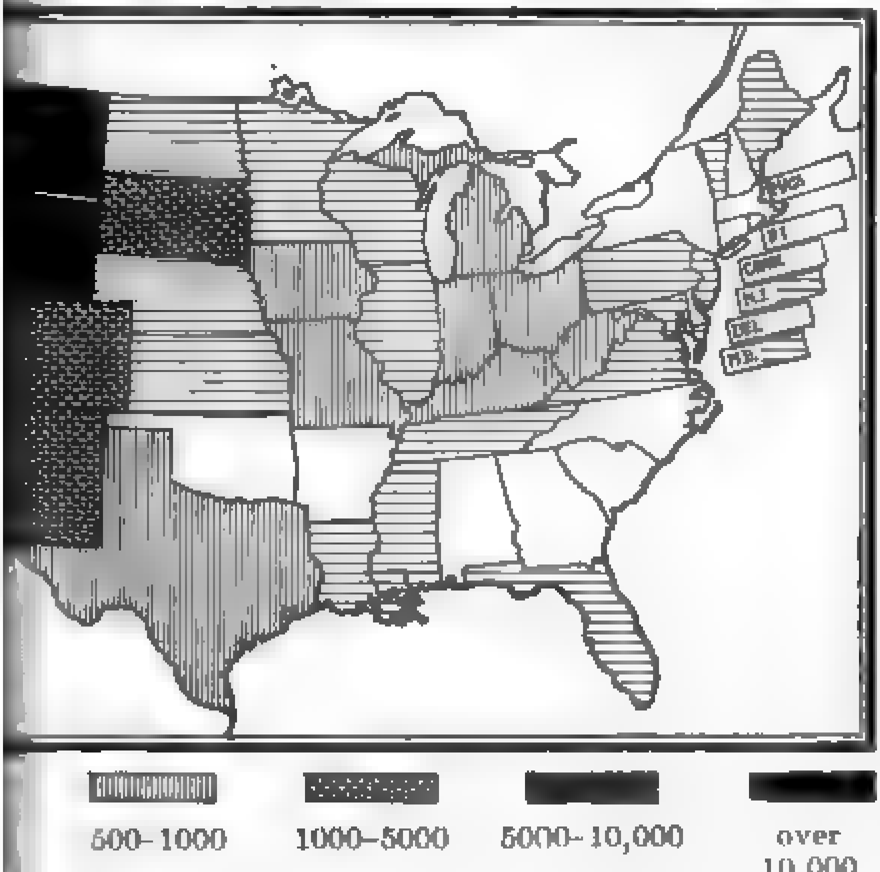
raising. Back of the mountains is a wide expanse of interior, too dry for the plow, and where the climate and the pasture conditions are suited to sheep where not too dry for pasturage, as in the Kalahari desert, which corresponds to the central desert of Australia.

Western United States.—The plains of the United States have not been at any time so exclusively devoted to sheep raising as have similar parts of Australia and the Argentine Republic, because the vigorous and hostile Indians held the American plains against the advance of the white man until the railroads came. Then cattle could be sent to market, and the sheep-growing and wool-exporting stage so common in the Southern Hemisphere was less necessary. The first industry of our West was the rounding up of cattle on the plains by the cowboy. Sheep herding came later and has had large development, especially in Montana, New Mexico, Utah, and Oregon. The sheep usually roams on Government land, an open, unfenced range where the grass belongs to any beast that eats it. The sheep eat it more closely than cattle do, leaving nothing behind them for the cattle, and often destroy the grass itself by pulling it up by the roots. A bitter animosity between the sheep owners and cattle owners has resulted, sometimes leading to fights involving loss of human life and the destruction of herds of sheep and cattle.

Wool Sheep, Mutton Sheep, and Refrigeration.—In the newer quarters of the world, the earliest object of sheep keeping was the production and sale of fine wool, for which the merino is the best breed of sheep. By careful breeding and selection through many centuries it has been developed into a little bony animal, with a wrinkly skin, thereby furnishing for a minimum of food a maximum amount of surface covered with a long, fine fleece which has at times been known to comprise with the grease 36 per cent. of the weight of the entire animal and have 48,000 strands per square inch of skin.

In the decade between 1880 and 1890, the perfection of cold storage and refrigeration suddenly caused a demand for mutton at Buenos Ayres, at Wellington, New Zealand, at Melbourne and Sidney, Australia, as well as at Chicago, Kansas City, and Omaha. The rising price of meat since 1900 has emphasized

de the carcass more valuable by far than the
sheep, with his excellent fleece, had no
while the mutton-loving English had carefully
e Lincolnshire and the Southdown and other
to grow large and fat and make fine mutton,
coarse and meagre wool. The refrigerator
the big, fat sheep more valuable in the Argen-
ana, and Australia than was the little merino
. As a result, the sheep breeders at once
g their flocks for mutton rather than wool,



ted States per 1000 population, by states, Jan. 1, 1912. Pop., 1910.

the sheep were half Lincolnshire, then three-
n seven-eighths. As a result, the people of
at antipodean mutton, but the wool market
by the great increase of coarse wool and the
ol. New Zealand and the Argentine Republic
sheep more rapidly than Australia, because in
the great droughts often make it impossible to
rket, so they have clung longer to the wool sheep.
Farms of Eastern United States.—The older
ely, the farms of eastern United States and

Europe, which were the sole dependence for sheep before 1850, still keep sheep but they are in small flocks grazing in fenced fields. When the remote regions took to producing so much fine wool there was an added reason for the farmers to devote their attention to the mutton breeds. In the United States these sheep are, like the cattle, usually migrants. The full-grown ewe is brought from some place in the West to Kansas City, Omaha, or Chicago, and then sent to the farms of Wisconsin, Minnesota, and eastern states where the farmers keep them for several years. Each year a crop of lambs is sold and finally the fat old ewes are sent to market and another supply purchased from the distant regions where the young sheep, like the young cattle, can be raised to maturity more cheaply than upon the small farms. These small flocks that can receive the personal care of their owners fare much better and produce a larger proportion of lambs than can be raised in the large flocks upon the range, where less attention is given them. Many of the eastern sheep owners make a specialty of rearing their lambs in the winter season and sending them to market early in the year when they command a very high price.

There is a considerable area in the southern Appalachian highlands of Tennessee, Virginia, and West Virginia where ewes are grown and sold to the farmers of the Great Valley and the Piedmont sections of Virginia, Maryland, and also lower Pennsylvania.

New England, with its rocky and little used farms, ~~offers one~~ of ~~the best~~ places in the United States for the ~~extension~~ of sheep growing. ~~The rocky lands produce~~ grass and there might be worked out a combination of hill pasture and valley-grown winter forage such as exists in the arid West with its irrigated valleys.

At the present time rather more than a third of the sheep in the United States are east of the Mississippi River. It is a common practice of some corn-belt farmers from southern Michigan to central Nebraska to buy carloads of lean lambs from the western range in the autumn, and fatten them on corn and hay for the winter market.

Sheep in Western Europe.—The great increase of sheep in the Southern Hemisphere has helped local causes to produce a general and heavy decline of sheep keeping in Europe, specially in the

parts of it. Throughout western Europe the
sembles that of the eastern United States and
on are of more value than wool. The German
ly declined as population and the demand for
ised. The field in grain will produce more food
ture, so that the grain field, the garden, the dairy
r field, have taken the place of the sheep pasture
he valuable wool can be imported more easily
food products. In France also the grain fields
me of the sheep pastures. Some fine mutton
continue to be kept in the most intensely culti-
rope, as in Belgium, Holland and Germany, but
in the poorer, more scantily populated parts of
The European sheep are fed much on barley
lent cabbage-like plant that grows in sandy soil.
n less change in the sheep industry of Great
any other country of western Europe. The
arly start at sheep keeping; they prize mutton
itish mutton; their moist climate gives abundant
y of free trade makes easy the importation of
ltivated much less than in France or Germany,
re sheep and cattle pastures. Since the recent
vier land taxes, there has been a distinct change
riculture and less pasture, which will tend to
d increase grain. The chief British sheep dis-
hlands of north England and of Scotland and the
here the Lincolnshire sheep has developed an
o survive on moist level land. Great Britain,
s as many sheep as people, has more sheep per
n the United States, and in actual number about
s Australia, twice as many as France, four times
many, two and one-half times as many as Spain,
irds as many as Russia, which on account of
mewhat arid eastern part, is the leading sheep
try of Europe. But sheep have declined in
western Europe, although a recent report to the
nent of Agriculture states that the country is
aining 300 million. If so, it would probably be
f other production.

Sheep in the Mediterranean Basin and Central Eurasia.—The California climate, with its winter rain and dry summer, is very wholesome for sheep, especially if they can have mountain pastures. The similar ~~climate of the~~ Mediterranean countries of north Africa and west Asia produces another region ~~where~~ sheep do well if the food ~~be present~~. In this belt is Spain, with as many sheep as Germany, and Bulgaria, mountainous and dry like Spain, also equals Germany in sheep.

In the dry region of southeastern Russia the conditions of the American and Argentine ranch are nearly duplicated, with similar conditions of sheep production. Much of Siberia and central Asia with its thousands of miles of plains or steppes is too dry for anything but pasturage, and some estimates credit Asiatic Russia with a much higher number of sheep than that given in the table.

Sheep are very common and very important in Turkey, as in semi-arid Asia Minor, Persia, Afghanistan, the mountainous parts of India, Thibet, Manchuria, and the interior dependencies of China. From all these countries there is an export to the western world of the coarse wool yielded by the hardy native sheep belonging to those careless Asiatic peoples who have never possessed themselves of the better breeds of western Europe. Throughout this whole region from the Bosphorous to the Amur Valley the sheep live almost entirely by pasture, which is subject to the cruel uncertainties of climate; and despite the shifting of flocks from place to place, as described in the book of Genesis, disasters occasionally occur. "Unlooked for heavy snow storms occurred in January, 1911, in Asia Minor. In the autumn months of 1910 almost 300,000 head of sheep, one and two years old, were being driven from Suleimania, Kerkook and Mosul toward Aleppo and Alexandria to be shipped to Alexandria, Egypt, for mutton; 90 per cent. perished en route."

Sheep in Tropic Highlands.—There is some sheep husbandry for local use throughout the mountainous regions of Mexico, Central America, and the Andean regions of South America. In Ecuador, Peru and Bolivia, the Andean plateaus spread out in greater expanse and, with their rough surface, cool and semi-arid climate, are a good place for sheep and there is an

It is true these countries are in the tropics, of the Bolivian plateau wear woolen masks to s from the biting blasts of the winds that sweep ape 2 1/2 to 3 miles above sea-level. Such a atural home of fleece-bearing animals and it ree in the llama, the vicuña, and the alpaca. imals, the llama and alpaca, furnish for export long, soft wool, but the animals themselves aled to the people of other countries as suitable

of sheep flocks in the old countries and the tions in the important new countries it is inter- e appearance of a possible new region in high- frica. Five million sheep are now reported in rica, but most of them of the native woolless ments at breeding up from these hardy sheep

first cross shears 1 1/2 lb. wool worth 5 1/2 ¢ per lb.
second cross shears 3 lb. wool worth 15¢ per lb.
third cross shears 4–5 lb. wool worth 16¢ per lb.

he goat, a producer of wool, zoologically a cousin associated with him throughout the world; the separation between the two being the goat's a less hospitable environment and food supply. ty to eat almost anything indicates that it is est of animals, capable of living under the most . Accordingly, where land is good and pastures e few; but where sheep can scarce subsist, the the browse of desert and mountain shrubbery. es that kill the sheep or else scrambles to an y pinnacle for safety. The semi-arid countries predominate in the possession of the world's ts. Thus Mexico is credited with 4 million, nited States or any country of Europe; Algeria siatic Turkey, 9 million; British South Africa, British India an enormous preponderance with e result is that goat skins, which with sheep ortant in the leather supply of the world, come

from the poorest countries of the world. Many are exported from China, whence they are brought by caravan from Mongolia and the central deserts of Asia. They come from the arid parts of India, from Persia, from Italy, and from the edge of the Sahara. Most goats are of commercial value only through their skins, but in the district of Angora, Asia Minor, near Anatolia, has been developed the Angora goat whose long, silken fleece, called mohair, competes with wool in making the finer fabrics.

Mohair.—The demand for mohair for making cloth has caused a great increase in the keeping of angora goats. They are now especially important in South Africa, where the dry pastures bordering the Kalahari desert produce a large quantity of the world's mohair; and its quality is said to exceed that of the parent Asia Minor district, which exports about 120 million pounds a year, largely to England and United States. Recently these animals have received favorable attention in the United States and are quite widely scattered over the country, especially in New Mexico and Texas. They eat leaves of trees as readily as grass and they are utilized to some extent to destroy bushes and underbrush where it is desired to convert forests and thickets into cleared lands and pastures. This same browsing ability of the goat and camel has made them effective agents in the denudation and destruction of Mediterranean lands.

The Future Supply of Wool and Mutton.—Unless we change our habits with regard to wool and mutton, the future supplies of these articles must be more extensive than that of the present time to keep up with increasing demand. Yet it is true that during the last quarter of the nineteenth century the world's sheep reached their maximum number under present conditions of production. As most of the new great plains have been fully occupied, increases of wool and mutton can only be made by improvements in the wool-yielding quality of the sheep themselves and by the greater intensity of agriculture which must cause a greater and greater portion of the world's sheep to be kept on farms in small flocks as they are in western Europe and eastern United States. As this method, with costly land, its building of barns and storing of winter food, is more expensive than that by which a single herder drives 2,000 or 3,000 sheep

barnless plain, costing little or nothing, rising
n and wool seem probable.

9. DRAFT ANIMALS

nce upon Beasts of Burden.—Although man
arth, he is physically weak in comparison to the
nd has been able to possess the earth only by
greater strength to his aid. The European
d no draft animal whatever in the United States,
s far to explain the Indian's lack of civilization.
s, he could not make the start from barbarism.
to do his work and give him food, he was always
had to live from hand to mouth and did not
sary surplus to give him the leisure to learn,
vance.

een less room for roaming, and more natural
ettlements and property in the United States, the
bably have been domesticated here as were rein-
k of Asia. Some draft animal seems necessary
a people toward civilization, although in parts
hina it has been shown that they can ultimately
minimum. Fortunately, while strong enough
ntelligent enough to be trained, the animals are
o be ignorant of their powers and thus obey us
Magazine, June, 1909).

's work has been done by ten animals—five of
world-wide distribution, the horse, ox, ass, mule
ive of very special location—the camel, elephant,
and llama. Our methods of using them vary
e nature of the work, climate and roads, but our
n them is so absolute that if they should suddenly
the earth, western civilization would be shaken
ons and millions of men would probably starve.
improvements in machinery it is upon the muscles
nals that we depend for the production of nearly
use in Europe and America.

RAFT ANIMALS OF GENERAL DISTRIBUTION

e.—The horse, the aristocrat of draft animals,
as much work as all the other draft animals put

together. He lives throughout the temperate zones except in the most extreme deserts, is only barred by the tropic forests and the snow-covered north and even there he is of value, as shown by the surprising efficiency of Manchurian ponies in an English Antarctic expedition of 1908–09. Chiefly because of the attacks of insects, the horse does not do so well in the more humid parts of the tropic and sub-tropic regions as in dry climates where there is sufficient food. He is largely limited to the peoples of the Caucasian race. Thus the United States (24 million), Canada (2.3), Europe (44 million), and Asiatic Russia (10 million) have about 80 million out of the 99 million horses reported in *Year-book* of United States Department of Agriculture. By contrast, India had 1.6 million horses, 78 million cattle other than dairy cows, and 17 million buffaloes—convincing proof of the superiority of the bovine over the equine genus as tropic denizens.

For many centuries the Arabian horses, fed partly upon the barley of the oases, were supposed to be the best of all horses, but several importations of the best Arabian steeds throughout the nineteenth century have shown them to be inferior in speed, strength and endurance to the breeds of western Europe. Partly Arabic in their origin, they have for several hundred years been bred with greater care in the selection of only the best parents for each new generation, with the result that the horse of the West now surpasses his distant cousins in the old home in Asia. The English especially are great lovers of the horse, and for several hundred years have been the leaders in the improvement of the breeds.

The Types of Horses.—There are three general types of horses. First, the heavy draft horse to draw heavy loads. This class originated in the good agricultural lands of west Europe. The second class is the thoroughbred or running horse, a product of England's race courses, and the third class is the driving horse. Of these latter there are many kinds, including the trotting horse, or roadster, developed in America. There are various sizes and minor classifications in each of the three classes.

As an industry, the production of horses for sale is always carried on in regions that are good for the production of cattle because both animals have the same physical and climatic wants. The

hay and his pasture grounds has the choice of
in the form of grain and hay, as cattle, or in
le form of horses. The form he selects depends
skill and taste and the district in which he lives.
of forage will usually be of more value when
horse than when converted into a bullock or cow,
nervous, sensitive, high strung character of the
ore care, watchfulness and labor to bring him to
ut accident, which so often reduces or destroys
e.

d Growing of Horses in Europe.—In northwest-
y horses are raised, but, as with cattle and sheep,
insufficient to meet the needs of the people.
heavy draft breeds, called the Shire and Clydes-
Belgium is a famous market for the sale of the
lraft horses grown in that vicinity. The north
ces many horses of the Belgian breed and also
amed from the French department De Perche.
g to an infusion of Arabian blood, is the quickest
raft animals, and was long used to draw the
e streets of Paris, but in January, 1913, was
by the automobile. The Percheron is the lead-
in America, the Clydesdale, Shire, and Belgian
d to a lesser extent.

he greatest horse-growing region is the grassy
North Sea. From northeastern Prussia come
orses, an industry which is encouraged by the
nent which has so great an interest in its army.
een an important exporter of heavy draft and
Germany and England, but the Danish farmers
hey can get better returns from their oats, barley,
erting them into dairy products. In Hungary
s are allowed to run in large herds on the level
prises most of that country and which in the
ther too dry for grain growth but excellent for
Russia, with a hundred million people and half
e, including an enormous region of level pasture
half the horses of all Europe, and recently had
her country in the world, and now has about the

same number as the United States. Russian horses are most extensively grown in the central, southern and southeastern parts of the Empire.

THE AMERICAN HORSE INDUSTRY

Horses of the European breeds early made their escape from the Spanish settlements in Mexico and ran wild on the western plains and mountains for three centuries until, with the buffalo, they vanished before the American settler in the last quarter of the nineteenth century. A few bands have survived into the twentieth century in New Mexico and Colorado. These wild or half wild horses usually called Indian ponies or Cayuses, had degenerated in size but developed wonderful endurance. After the first settlement of the Plains, they ran on the range and were cared for like range cattle, being caught up at intervals, branded, and sold when ready for the market. Like the wild cattle this breed has now almost disappeared through admixture with the European breeds brought from the eastern states.

One of the best-known centers of American horse production is the blue grass region of central Kentucky, with the city of Lexington as its center. This plain of eight or ten thousand square miles is underlaid by a bed of limestone which upon exposure to the air breaks up into a soil of great fertility and one in which blue grass grows to perfection. This is one of the best of pasture grasses, especially for horses, which may be called one of the chief money crops of this region. Trotting and carriage horses are the chief kinds and the horses from the Lexington market are to be seen prancing through every fine city park in the United States and many of those in Europe. The small area of the Kentucky blue grass region causes it to be of far less total importance in horse production than is the corn belt.

Throughout the whole extent of the corn belt alongside the farms where some men are fattening pigs and others fattening cattle, still others have droves of colts usually of the heavy draft breeds originally brought from France, Scotland, or Belgium. When four or five years old, these horses are sent by carloads to the eastern cities and to many agricultural districts in the east where the farmers find it more profitable to raise crops suited to

and buy their horses because they can so easily
. The industrial depression in the United States
particularly severe in the horse market. In ad-
l stagnation, the bicycle and electric trolley car
xtending in use, with the combined result that
cheap that a five-year-old would sometimes bring
he had as a six-months-old colt. At that time
dealers sought a market in Europe and began an
which has continued to the present time, the chief
England, Germany, Holland, and Belgium. In
ıada also participates, the farmers of Ontario and
ing nearly one-third of the horses exported to

casional horse ranches on the Great Plains of the
rom Canada to Mexico, whence horses are sent to
timber camps of the mountains.
f a few colts is a widely scattered supply crop and
money crop on some farms in almost all parts of
tes. It is of greater importance in the Piedmont
ıern Virginia than in any other district east of the
Excellent cavalry horses are produced here and
tes Government maintains a remount station at

.—Where the horse has been long in regions of
pply, he has degenerated in size. Ponies have
luced, the breeds usually bearing the name of
—Russian, Manchurian, Welsh, Iceland, Orkney,
ıtecas, and many of them show pronounced
heir environment. The Zacetecas pony from the
of that name is of Spanish stock, sleek of coat,
ıd fleet from the climbing of high mountains and
arid country for his food and water. The slow,
oarse-maned Shetland pony with his long and
ıs been produced by the humid, raw and cold
heather-clad hills of Shetland near the latitude of
ıland. Grant them pasture, hay, and a shed in
increase in height 10 per cent. in a generation.[1]
'he Mule and the Donkey or Ass.—The mule,

[1] *The Shetland Pony.* Shetland Pony Club, Lafayette, Ind.

which has a donkey for a father and a horse for a mother, is in some respects a better draft animal than either parent. The donkey is conspicuous among the common draft animals because of its extreme hardiness, longevity, and ability to thrive like a goat upon rough food and under poor conditions. The wild ass is still found in the most desolate parts of Turkestan, where his fleetness and hardiness enable him to survive even in the home of the wild camel. From this parent the mule inherits long life,

Fig. 71.—The Shetland pony with its long coat is an interesting response to an environment. (Photo C. S. Plumb, Columbus, O.)

a hard small hoof, sure footedness, and the ability to thrive on little food, in all of which respects it excels the horse, from which it inherits size and strength. The chief reason why the mule has not displaced the horse in many more lands than it has is a question of pride. Men love their horses and admire them, but the mule with his long ears, his noisy bray, and a superior intelligence which makes him resent abuse with his heels, is not so much loved or so popular. For nearly all kinds of service he is

or animal, yet the world's horses are six times as
mules and asses combined.

ion of Donkey and Mules.—The mule and the
lly the donkey) prevail where conditions of life
Asiatic Turkey and India have nearly half the
orld and Spain, Italy, and Algeria have a fourth.
ance, with its rich pastures, produces the fine,

key, servant of the peddler of American oil in Portugal. (Standard Oil Co.)

and the French coach horses. But southern
drier climate of the Mediterranean, has poorer
e mules and donkeys are bred. Spain has half
ope, and from its arid plateaus exports to all the
sses to be used in the breeding of mules. Spanish
e-fourth as numerous as the donkeys and mules.
desert region from Morocco to Pekin the
key climb the hills, thread the mountain passes,

browse on the arid plains in companionship with the camel, which braves the worst desert, the ox that draws the creaking cart, and the horse that bears the proud chieftain.

In the mountains of every country and every state between Alaska and Patagonia, the mule and the donkey are of great relative importance. They serve wherever work is difficult, as in climbing the mountain trail, hauling loads of logs in lumber camps and cars in mines. They toil alike upon the fearful trails from the ocean to the Andes beneath the equator, or before the mine car filled with gold ore in Colorado, with coal in Pennsylvania, or lead in the Altai Mountains of Siberia.

Good mules are grown and used in Manchuria and north China and even exported from Tientsin for service in the British army in India (U. S. Con. Rep., March 16, 1911). In Peking the mule has the favored position of being the chosen driving animal of the government officials as they travel about the city in their "Peking carts."

The ability of the mule to resist more humidity of climate than the horse gives him prominence over the horse in the tropics and in the southern part of the United States. In Illinois, Iowa, and Kansas the mules comprised 5 per cent. of the 4 1/4 millions of equine draft animals but more than half of the 1 2/5 million in Alabama, Mississippi, and Louisana were mules. Some of the cotton states show a greater number of mules than do the mule-producing states, for the cotton cultivator is almost universally muledrawn. The mule often stays in the state of his origin but two or three years, but plows cotton for twenty years.

The American Mule Industry.—The finest mules in the United States are grown in the horse belt of Kentucky and adjacent districts of Tennessee, where the mothers are of the driving horse breed. Missouri is probably the greatest mule-producing region of the United States and under a single roof in St. Louis 5,000 mules are sometimes for sale. From this market, and from Kentucky and Tennessee, they are distributed over a very wide area in the United States and in foreign countries. Whenever there is war, the demand for mules arises to bear the army burden. When Spain was at war with Cuba, she bought American mules for the use of her armies in that island and during the three years of the Boer War in South Africa our mule export was

ıormal figure. The English dependence upon
ı was so great that officers of the British army
rters in all the American mule markets, bought
ıousands, sent them from New Orleans to Cape
ıds, and so reduced the number in America that
l (1912) higher than that of horses. These mules
eputation that the Johannesburg Corporation
nules in January, 1911, stipulating that they
d in Missouri (U. S. Con. Rep., March 16, 1911).
doubt that with the increasing cost of horse feed
ıtes the good qualities of the mule are being more
l his use is becoming more extensive. From
e number of horses increased about 35 per cent.
es about 95 per cent.

[n almost all cattle-keeping countries oxen are
extent at least, as work animals, but not so much
s, because of the competition of the more efficient
and donkeys. Among the peasants of north-
even the cow that supplies the family with milk
essed to the wagon to help with the farm labor.
low, the ox is unquestionably stronger than the
in the mud of a swamp, will pull where a horse
make a try. Consequently, their most general
d States is to haul logs in the lumber operations
ıd they are also of value on the rocky lands of
'here the ox is more common than in any other
ted States. In the muddy sugar-cane fields of
e very bad roads in parts of tropic America the
s generally used because it is the best wheeled
the special conditions, which often resemble
:ass or lumber camp.

rlculture.—The general use of oxen in agricul-
ıually an indication of an industrially backward
willing to content themselves with slow helpers
ke advantage of the factor of cheapness arising
at the ox can eventually be sold as a beef animal.
ıtion of oxen and primitive agriculture we find
enians, Bulgarians, Turks, and other peoples of
ıstern Europe, and in places throughout central

Asia to Pekin and Manchuria. The Boers of South Africa still continue to use teams in which several spans of oxen draw a wagon of enormous size.

In India it is probable that there are as many oxen used as in all the rest of the world. The hundreds of millions of people there use almost no other beast of burden. As cattle can survive the tormenting tropic insects better than horses or even mules, oxen are probably the most used agricultural work animal of the tropics. In Porto Rico, for example, they are the mainstay. On the muddy roads and muddy rice fields of the Philippines and southeastern Asia the Carabao or water buffalo, an economic duplicate and a zoologic cousin of the ox, is the prevalent beast of burden, although his slowness probably makes him the least efficient of all the larger draft animals. India's 75 million cattle other than dairy cows make that country far and away the leading cattle country of the world without counting the 15 million buffaloes that really belong in the same class economically.

5. The Dog.—Least important of the general draft animals is the dog, rival to man in his ability to live in all climates. He goes wherever man goes, living on a diet of meat and fish if upon the shores of the Arctic Sea, or of beans and bananas mixed with a little meat in Equatorial Africa. As a draft animal he is to the snowy parts of North America what the reindeer is to Lapland. He had drawn the sledge of the Aleut and the Eskimo, the Hudson Bay fur trader, the Labrador explorer, and the gold prospector in Alaska and the Klondike. He does the same service in some of the colder parts of Europe and Asia, but it is probable that the dog is most used in the densely peopled agricultural regions of northwestern Europe. In the north of France, Holland, Belgium, and western Germany regions where the horse predominates, it is a common sight to see a team of two, three, or four muscular dogs hitched to a surprisingly heavy cart, taking to market a load of milk, vegetables, or other farm products. It is not uncommon to see a peasant woman on one side of the wagon tongue and the dog on the other. This hard labor is due to poverty, and the poverty is due to the density of population, which only leaves a small patch of land for each family so that they cannot feed any larger work animal than the dog. In parts of Germany the pet dog is heavily taxed, but the work

In Japan, the population being still greater in
resources, man is of necessity his own beast of

HE DRAFT ANIMALS OF SPECIAL LOCATION

t animals of special location are generally inferior
1 the mule, but have some peculiar adaptation to
at enables them to work in places where the horse
ss efficient, if they can survive at all.

leer.—The reindeer is a specialist at surviving
diet, such as the moss which grows on the other-
ıd of the almost continually frozen Arctic plains,
Over this bleak, treeless, and uninviting Arctic
ou and other species of the reindeer family are
ted. Two domesticated kinds of reindeer are
rse populations from the Atlantic Ocean in north
mchatka and Bering Straits. Their southern
Asia reaches almost to the Amur River and Lake
s vast region the population is very sparse, and
the reindeer chiefly as a sled animal, although
y ride him. The reindeer are essential to the life
se people, for in addition to acting as beasts of
rnish milk, skins, and meat to the herdsmen, who
their sole wealth. The recent introduction of
ıska and Labrador, countries similar to their own,
ıccess; their number in Alaska has increased to
ill probably be but a short time before they are
ughout the Arctic and sub-Arctic regions of
The first commercial shipment of reindeer meat
hed Seattle.

-The yak, a close cousin to the ox and the buffalo,
e Himalaya Mountain regions and is adapted to
and scanty food, but especially to deep snow.
of his body have long thick hair reaching nearly
o that he can lie on this natural mattress with
mfort on the deep snows of high mountains.
ıt present used only in Tibet and the adjacent
central Asia, where he draws carts and carries
ack. The naturalist, Mr. Thompson Seton, has
large areas of Canada, not well suited to ordinary

cattle, might well be given over to yak pasturage. The yak has shown his fitness by thriving for six generations in an English park.

3. The Llama.—The llama of the highlands of Peru and Bolivia does for the Andean Highlands the service rendered by the yak in the Himalayas. The llama is a small animal resembling both the sheep and the camel, and is used only for carrying packs which cannot exceed a hundred pounds in weight. He does not have great amounts of snow to contend with, but for sure footedness in climbing the exceedingly precipitous Andean heights, the llama has no superior. It is possible that the llama, as well as the yak, might be a source of profit in some other mountainous regions.

4. The Camel.—The camel is well known as a specialist in the ability to survive in comfort for several days without food or water and to live upon the harsh vegetation of the desert. From unknown antiquity this animal has been distributed from the western Sahara through Africa and central Asia to eastern Mongolia, and has lately been introduced into the Australian desert. There are two kinds, the one-humped and the two-humped or Bactrian camel. This latter is found all the way from the Crimea in south Russia to Pekin, and from the trans-Siberian railroad to northern India, where it crosses the territory of the yak. Without the camel many parts of the desert region of Asia and Africa could not be inhabited and many deserts over which caravans have passed for ages could not be crossed. The largest heavy draft camel can slowly carry a pack of from 700 to 1,000 pounds, the fastest saddle animals can take a man a hundred miles a day; and they can carry these burdens for several days, living the while upon the accumulated fat which has been stored in the humps upon their backs. This storage of energy in the camel's hump is like that accumulated by the pig and the bear in autumn to enable them to lie for days contentedly in their beds when the winter season makes hunting for food difficult. The camel, on the contrary, uses his surplus to carry him over a hard region rather than a hard season. One attempt was made to introduce the camel to southwestern United States, but it was interrupted by the Civil War. There is no apparent reason why he should not thrive and be useful there.

nt.—The elephant has a restricted field of use-
he lives only in the tropical forest regions of
He is an enormous feeder, eating in proportion
ore food than any of the other work animals, so
ised only where the humid tropic climate makes
bundant. Only Asiatics have been energetic
sticate him in modern times. Many of the work
ught wild in the forests, and then, with the assist-
phants, are laboriously broken to do the work of
w plows and wagons and carry passengers on their
iost useful in lumber yards where with great skill
iese live cranes lift and pile logs which a dozen
e difficulty in handling. In times of war they
l, lifted, and placed cannon for artillery regiments,
r part of the British army equipment in India.
l years ago the Carthaginian armies invaded
with war elephants. To-day the African ele-
and is pursued with relentless vigor into ever
s and slaughtered at the rate of 60,000 per year
iation threatened because of his valuable ivory.
egion where none of the other domestic animals
of climatic conditions and where land trans-
essity falls upon the backs of men. It would
oderns, if possessed of any spark of appreciation
ould duplicate the achievements of the ancients,
e elephant and give to central Africa the most
easts of burden where it now has the least effi-

i have some hope of a beast of burden through
ess of a new hybrid, the Zulebra, a cross between
ebra—an equine that resembles the horse quite
ass does. The African tsetse fly kills all the
, but four species of zebra are native and immune
for an efficient new work animal for which
quare miles of middle Africa are sadly in need.

RY AND SMALL ANIMAL INDUSTRIES

to be small discernable relation between the
idustries and the amount of attention that is

bestowed upon them by economists and publicists. Wheat, cotton, and iron seem constantly before the scientific mind if we may judge by the number of books, treatises, articles, and statistical analyses pertaining to them. The intellectual neglect of the lowly hen is not due to unimportance, for poultry and eggs of the United States (750 million dollars' worth[1] in 1911) are of more value than the wheat crop, the cotton crop, or the hay crop and are exceeded only by the corn crop. The pig iron output of all our furnaces is far exceeded in value by our poultry and eggs. This lack of interest may be partly explained by the universality of production, the non-capitalistic production, the difficulty of securing statistics, the absence of large financial or speculative operations in connection with poultry and eggs, the small influence of legislation upon them, and the small part they play in international trade. Poultry keeping is none the less important and is undoubtedly the most universal form of animal industry in United States and also in Europe, east Asia, and other foreign countries. The names of breeds attest their world-wide distribution—Peking and Muscovy ducks; Cochin, Brama, Leghorn, Hamburg, Minorca, Indian Game, Wyandotte and Plymouth Rock chickens; Brabant geese.

Fowls are found to some extent in great cities and are kept in villages as well as on farms throughout the United States. They are usually a kind of by-product, often a perquisite of the farmer's wife. "The very large majority of the fowls in this country are found in comparatively small numbers (42 per farm in 1900), on a very large number of farms, where they gather their own subsistence, and receive practically no care. The consequence is that the eggs are produced at little cost. The development of this industry to an extent incredibly larger than it is at the present time is among the easy possibilities."[2]

There has been a marked increase in the number of specialized poultry farms since 1900. One of the causes of this change is the work done by the mechanical incubator. It works on a very large scale, and is as successful as the hen, who is now free to devote her whole time to the production of eggs.

[1] Year-book Estimate.
[2] Distribution and Magnitude of the Poultry and Egg Industry. U. S. Department of Agriculture, *Year-book*, 1902.

ing is equally well fitted to be a by-product in
ilture or a main product in intensive agriculture
endency to be important where agriculture tends
. Thus egg production predominates in value
tensive poultry selling (meat production) in all
States except the region south of the Potomac
s, which have no local markets of importance,
ie corn belt which have unusual opportunities
y. In Maine and New Hampshire the eggs are
e value of the poultry. The relation of poultry
n is well shown in Canada. In 1902 Canada's
ounted to nearly $2,000,000. It decreased
910 eggs were imported from China and Russia.
opment of railroad building and wheat growing
has enlarged the Canadian market and afforded
pportunity for the people of the eastern provinces
e exported eggs. During a similar period of
ment the United States poultry industry went
e fluctuation. In 1870 a great railroad building
velopment began and in 1872 our egg imports
5 million dozen. From 1882 to 1890 they were
ı per year, then suddenly fell away during the
ind their export rose steadily from 1897 to 1911,
8 million dozen.

the best evidence of the suitability of the poultry
isive production. It is the general testimony of
normous quantities of poultry are grown, and
ted. Factories in Tsingtav, German China,
of dozens yearly into dried eggs, dried yolks
ried white of egg). By this means 1,000 eggs
to 22 pounds' weight. easily transported and
lefinitely.

ggs in China helps to explain how the Chinese
o live at all on the very low wages of which we
ing so isolated, such a world to itself, has had
its own—low prices, so that the low-wage man
ed commodities. A few years ago eggs cost
(two cents per dozen, U. S. Gold.) at Yangtse
since the government has abolished the old

currency and the ten cash piece (cent) is the smallest coin, eggs are five to six and two-third cents per dozen at Shanghai (U. S. Con. Rep., May 10, 1912; July 6, 1911).[1]

The greatest commerce in eggs and, with the possible exception of China, the greatest production, is in Europe. Great Britain

FIG. 73.—Boatload of eggs on Chinese canal. Evidence of intensive agricultural industry. (From Farmers of Forty Centuries, F. H. King, Madison, Wis.)

imports far more eggs than all the rest of the world combined, nearly 200 million dozen per year. Russia sends the half of them, and France, Belgium, Germany, and Denmark are important contributors. Even Morocco and Egypt send more than does the United States. The European peasant farmer finds it more necessary to sell eggs than does the American with

[1] King, F. H (*Farmers of Forty Centuries*, p. 180), found eggs in early April selling near Shanghai, at forty-eight cents (American gold) per hundred, little chicks $1 29 per hundred. At the same place the wage of a man per ten-hour day was twenty-four cents, the price of four and one-sixth dozen eggs.

we are tending rapidly in that direction, as shown
oultry increase.
ng and especially egg production responds readily
g care of government or other outside aid. The
the laws of animal breeding cause large increase
egg output, as various agricultural experiment
shown. In the marketing, great improvement
proved by recent Irish experience. France and
the best eggs to the British market a few years
tly the Irish Agricultural Organization Society
ng of lectures and instructing classes in poultry
l organized cooperative societies for the marketing
he resulting improvement in the freshness, clean-
reful packing of the eggs has so greatly im-
tanding in the markets that Irish egg export
hird in six years, 1904 to 1910, and the Irish
y products is now greater than the butter export,
in value only by linen and cattle.
high value of output in proportion to food, it
phasized that the distribution of the poultry
ds more on man and less on the environment
of the animal industries thus far discussed. It
noted that in its large scale prosecution the
number the successes, because of the unusual
il involved.
ks, and geese comprise about 6 per cent. of the
rica, but despite the feathers of the ducks and
ds, because of their small number of eggs, lack
rce of income furnished by the chicken. In
tractable goose is esteemed as the untractable
erica, and it is common to see boys herding them
t pasture.
of rabbits and hares is, in its economic aspects,
poultry industry. Hares have the advantage
thrive in closer confinement than poultry, and
n a very wide range of vegetable food—weeds as
d grains. They are quite generally kept by
ers of northern France and Belgium, whence
ed to England by the hundreds of tons. The

total British import of rabbits amounts to over $5,000,000 per year.

In ostrich farming we have an interesting example of a new domestic animal and a new industry. This feather-producing bird is a native of semi-arid Africa, being found over most of the Sudan and large areas in South Africa. The Hamar Arabs in West Kordofan, Sudan, keep a few birds in pens, but the feathers are inferior to those from wild birds which were until recently the sole supply in all lands. The British in South Africa are the real founders of the ostrich industry, having found that when enclosed by a strong fence and supplied with suitable food of grain and good grass the ostrich will thrive about as well in domestication as the sheep. In forty years the Afrikanders have reduced ostrich keeping to a science, established systems of registry for pure bred birds and improved them to the point where $5,000 has been paid for a single bird for breeding purposes. The number of tame birds in the fields of Cape Colony farmers is estimated at 500,000, the best feathers sell at over $200 per pound and the feather export at $9,000,000 rivals that of wool even though the colony has 18 million sheep.[1]

To prevent other lands from starting up the industry, the export of birds and eggs is strictly prohibited. This much used mediæval device has worked fairly well in that the Germans have failed because of it in German Southwest Africa. There are, however, enough ostriches outside of Africa now to start the industry. An ostrich farm in southern California has attracted much attention and the climate of that district resembles that of the ostrich's native habitat. There are already ostriches in Arizona, Florida, Argentina, Australia, and New Zealand.

Bee keeping, with its products of honey and wax, preys upon the blind thrift of an insect. Like poultry it depends to an important extent upon the human element, but it also must have an environment affording nectar-bearing flowers. Where rainfall permits abundant vegetation, the tropics are best bee lands, and honey and wax are important exports from the Greater Antilles, and there seems to be plenty of room for extension of the industry.

[1] In one irrigated district on the Grobbelaars river two miles by seventy, 80,000 ostriches are kept at pasture on alfalfa. They yield over $20 apiece per year and the land sells for $750 to $1,000 per acre. A change in styles might change all this.

g the most highly developed of animals. Their done, one of the most scientific of the animal small amount of bee keeping is common in nearly parts of United States and Europe, but it is a ustry which, owing to its dependence upon bloom- ıot be intensified.

of song birds is an interesting avocation or by- night in its economic side be considered as a sort ultry industry—the artisan's poultry as compared poultry. The canary bird is the most important nd the Hartz mountain region of Germany, where industrial population in a mountainous district, enter of their production. These people are well receive low wages, and the rearing of song birds on at small expense in the home, very much like pets. A British working man is reported to have ne year breeding canaries. As long ago as 1880 ed that the sales of canary birds brought over ear to the Hartz mountain peasants, and St. naries are known in many lands.

of cage birds is a custom worldwide, and of un- large traffic in the birds has arisen only since the ransportation by steamships. The United States 00,000 birds per year, mostly German canaries, is increasing rapidly. Belgium, Scotland, and ially the textile districts of Norwich and Bradford, ı. So greatly have they been changed by their f domestication that they are now imported into Canary Islands. Two centuries ago there were arieties of this species and many of them are so n man that liberty would be death. The interest but inexpensive industry is attested by hundreds of bird raisers, bird shows in many cities, and nals of aviculture. The more abundant relation sources in United States is well attested by the only bird journal, and the practical absence of d raising in a country where they are bought by ousands.[1]

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CHAPTER VI

[ABLE, FRUIT AND WINE INDUSTRIES

nd Garden Products.—Nearly every farm has a len and some plants are cultivated and eaten by eople. Owing to the large yield of a small plot of intensive care such gardens are very common in nall towns of both Europe and America. Through income from this source, the retired farmer of le to live comfortably in country towns on sur- cash income from other sources.

pean and American gardens are to be found a f plants that represent in their origin every conti- st every country in the world. In many cases n cultivated until they bear little resemblance to rm, and in our list of vegetables is found in edible rt of a plant—roots, stems, leaf stalks, leaves, , seeds.

n-producing Legumes or Pulse.—The most im- the plants which we commonly call vegetables is egumes, comprising the many kinds of peas and lse in the Old World. These differ from all other he large amount of proteids or nitrogenous food, es, which they contain. (See table of food analy- , as food for man, beast, or plant is expensive to three-fourths of the air is nitrogen, which owing l inertness, is hard to obtain in available forms. cost. The legumes have the ability, great for the reater for the future, of producing upon their which are colonies of the microscopic plants called se organisms catch nitrogen freely from the air e the legumes upon which they live to render to vice of incalculable value by giving nitrogenous beast, or plant. By the aid of these bacteria the

legumes can grow in poor soil and leave it the richer in nitrogen because of the nodules on the roots that remain in the ground.

The pulse plants are represented chiefly by peas in northern climates and beans in southern climates, and are of less use in the United States than in any other large region. This is be-

FIG. 74.—The roots of the sweet pea, one of the legumes, with the nodules made by the nitrogen-gathering bacteria.

cause the people of the United States get their nitrogenous food in the expensive forms of meat, cheese, and milk, of which we use more per person than any other large group of civilized people.

In the United Kingdom, before the potato was introduced, pulse plants were more important than they now are, but there

dred thousand acres of them grown each year and ons of peas and beans are imported; the former nada, half of the latter from Egypt and Manchuria.

f Pulse to Poor Peoples.—In the Mediterranean ulse plants are much more important than among les of north Europe. The lower wages of the Spanins make it also impossible for them to buy meat s do the British, and the dense population comlack of grass make impossible the rearing of ade of meat animals per million people. Italy has -twentieth as many sheep as the United Kingdom as many cattle, and Spain, while it has as many on people as the United Kingdom, has but oneny cattle. But the poverty of the Spanish and auses them to export some of the little meat they England, with more meat animals, is the heaviest in the world. To get their nitrogenous food the ians, and other people of the Mediterranean turn e cheaper forms of peas and beans. The gram or d to be the leading article of diet in Spain, and is d by the peoples of Morocco, Algeria, and Tunis, rried by caravans into the desert in exchange for his, as with other staples of food, the European icient. In 1908, Spain imported 10,000 tons from England imports them especially for making ance imports not less than 35,000 tons per year India. Lentils, vetch, and lupine, other podlants somewhat like our peas and beans, are much out all Mediterranean countries, and from the there is considerable export of the flat seeds of the gume sometimes called locusts.[1]

e of the United States are more able than those of y meat, they use less pulse, and as the people of cher than the peoples of the Mediterranean and o are the peoples of the Mediterranean richer than occupy southeastern Asia. To the latter, ac- of the pulse family are an absolutely indispensable

s a substitute for oats in horse feeding and said to have John the Baptist in the Wilderness.

article of diet. Rice, substitute for bread and potatoes, is deficient in nitrogen, but peas and beans are grown throughout these countries to supply this need. In India, the chief dependence is the lablab pea, the product of a climbing vine, eaten by both man and beast.

In China and Japan the chief dependence is the soy bean, a nutritious legume with three times as much protein as wheat. It is cultivated among the Mongolian peoples in many varieties and eaten in many forms, including the oil as a butter substitute.

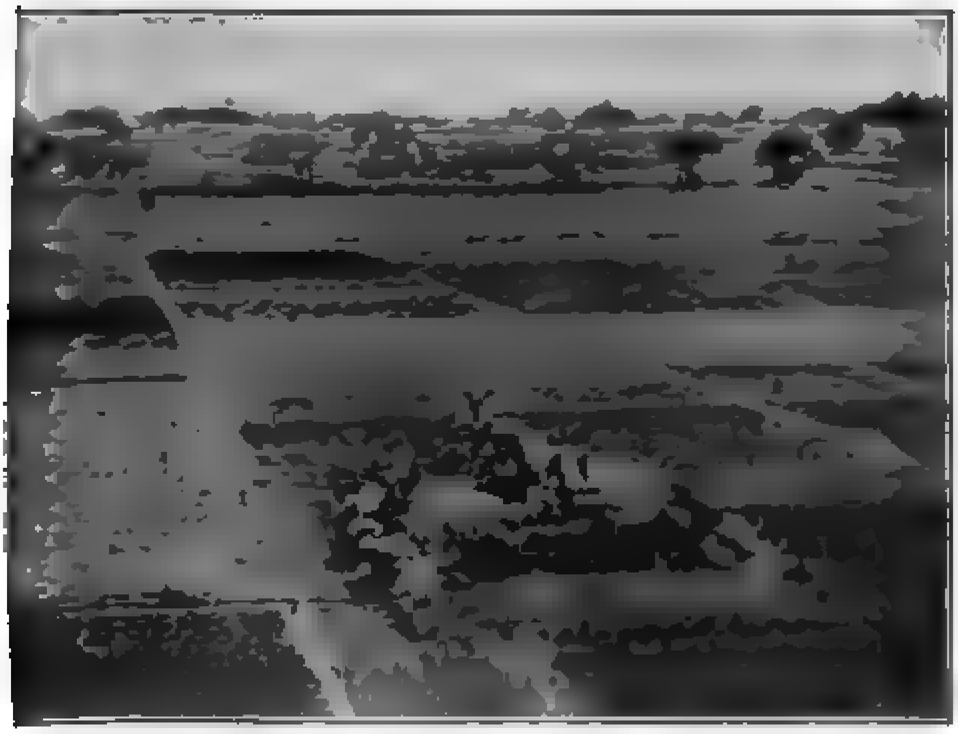
FIG. 75.—Chinese coolies carrying soy beans up to storage stacks for oil manufacture. Newschwang, Manchuria. (F. N. Meyer, explorer, U. S. Dept. Agr.)

Aside from this, the dietary use of the soy bean in the Orient is chiefly similar to that of our garden beans; the plant is a field crop of great importance. For example, the Manchuria crop of 1910 was estimated at 1,500,000 tons, of which 1,127,000 tons were exported, an amount one-half as great as the United States wheat export for 1911. Korea exported $2,500,000 worth in 1910, nearly all to Japan. In Manchuria and Korea the beans have been crushed between heavy rollers to extract the oil and the resulting cake has for centuries been carried in junks to Japan to feed cattle or to be used as fertilizer by the Japanese garden

ent British experiments have shown it to be al stock food than linseed cake or meal.

in 1907 that eastern beans were sent to Europe. to the utilization of the oil in competition with seed, and soap-making oils which had suddenly se.[1]

ess with which this oriental farm product sprang e is almost startling and shows what a resource we ommerce with the Mongolian brother when we



; water from well to irrigate Chinese gardens at Liao Yang, ence in the background is made of sorghum stems, and is cucumber and bean vines. (Photo F. N. Meyer, explorer,

procal relation. The trial shipments of beans to were followed by 100,000 tons in 1908, 245,000 1910, 800,000 tons to England alone.[2]

e in Vegetables.—On account of the large bulk nature of fresh vegetables they have been unim-

price of these beans has started their cultivation in aucasus. Five hundred tons were shipped to Hamburg 10, and an export of about 11,000 tons was expected for ya, or soy bean has been recently introduced into the e do not eat it but it is gaining in importance as a forage n fertilizer, because the crop following it is richer for the e roots.

ecognition of Japan.

portant in commerce until the recent improvements in transportation. Owing to the fact that statistics of domestic trade in America are hard to get, Europe affords us the best opportunity to see the magnitude of the present commerce in these products. In the United Kingdom alone the importation now amounts to from $60,000,000 to $70,000,000 per year. In addition to this there is a lively local trade between south and southwest England, the Channel Islands, and the colder parts of that country. These islands in the English Channel have a relatively mild climate, because surrounded by a comparatively warm ocean, which gives them the advantage of early maturity in their crops and the ability to grow those usually found further south, so that the newer industries are competing severely with the Islands' old specialty of dairying.

Daily steamers now take large quantities of garden stuffs, grapes, small fruit, and flowers to the English cities. Most of the vegetables imported into Britain come from the south of France, Spain, and Italy. The whole region north of the Alps receives large quantities of these southern products that are grown so easily in sunny Italy and Spain, while frost prevails in the colder north. France has a large traffic in early vegetables from her warm colony of Algeria, sheltered from the cold north winds by the waters of the Mediterranean. Egypt's sunny climate becomes of value to her through the 80,000 (1910) tons of early onions she exports between March and May to Liverpool, London, Hull, Hamburg, Trieste, and the United States.

Resemblance of Flower and Vegetable Industry.—The French have a flower industry so closely akin to vegetable growing in its economic and climatic aspects that it merits mention here. Every night during the winter months the "Cut Flower Limited Express" picks up ten car loads of flowers between Nice and Toulon for delivery in car loads to Paris, Frankfort-on-the-Main, Munich, Berlin, Vienna, St. Petersburg, and London, and Manchester, via Calais. This industry began about 1880 and has made such growth that a single Commune (Hyeres) has in its sheltered plain between the mountains and the Mediterranean 3,000 irrigated acres on which nearly 6,000 persons are busy raising violets to sell between November and March (U. S. Con. Rep., April 14, 1911).

n Trade in Vegetables.—In the United States the
a vegetables and garden products is no index of
ce. Trade between different states in Europe is
ilar trade between the states of our Union is local
d by statistics.
go each town and city depended upon its immedi-
vegetables, and there is at the present time a large
st every city where farmers grow fields of peas,
s and other garden crops, of which the family
a short row or two. The vegetables from these
s are usually consumed in the nearby market in
ripening, but months before the local supply is
roducts are sold in the city market. The best are
arby hot houses, but the great bulk is brought by
car, express freight, and the coasting steamer,
ossible the purchase of practically any vegetable
year. In emancipating the city from dependence
these transportation facilities have caused the
an enormous trucking industry in rather concen-
roughout the whole length of the Atlantic Plain
nd of Long Island to the tip of Florida. So im-
traffic now that sometimes a passenger train has
g while an express freight loaded with cabbage,
natoes rushes north.

oduction on the Atlantic Plain.—This Atlantic
y level area lying between the Atlantic Ocean and
n of hard rock that limits the sands and clays of
auses in the rivers crossing it a series of waterfalls
nearly straight line from New York southwestward
ies of Trenton, Philadelphia, Baltimore, Washing-
, Raleigh, N. C., and Columbia, S. C. This
omposed of sandy soil, is one of the least developed
nited States. Much of it is still in pine forests[1]
ndy soil has little plant nutrition in it and when
unsuited to the growth of grain or of grass and has
been considered barren by the grain and cattle
merica. Fortunately, however, this sandy soil

lives within 15 miles of New York City, on land smooth
the easy use of agricultural machinery.

suffices for the growth of excellent peas, melons, cabbages, strawberries, etc., which are composed almost entirely of water, and which have a much earlier planting and harvest-time on light sandy soil than on heavy clay soil, which does not dry so quickly as sand. Thus the Atlantic Plain has an advantage over the Piedmont and Appalachian districts lying to the west, with their fertile but heavy clays.

The fitness of this infertile sand for certain kinds of production is attested by the shipment in one season of $300,000 worth of berries (chiefly raspberries, blackberries, and strawberries) from the town of Hammonton, a station between Philadelphia and Atlantic City.

The possibilities of sandy soils for garden products are shown by the practice of some New Jersey growers who harvest on the same field a pea crop June 1, a cantaloupe crop August 15, and turnips October 1, and at the same time have the land well set in crimson clover, a legume which gathers nitrogen, makes humus, and is plowed under the next April or May, when nearly knee-high and full of scarlet blossoms. Another New Jersey truck combination is Canada peas picked May and June, followed by crop of corn with a legume side crop of vetch, cow peas, or crimson clover—to fertilize the earth. These are not average practices. They are exceptions showing the possibilities of a land most of which is entirely unutilized.

From this sandy Atlantic Plain there comes throughout the cooler part of the year a procession of vegetable products that follows the advance of the seasons.

When October's breath of winter turns the fields of New Jersey and Long Island brown, the huckster and the groceryman of the northern city begin to sell beans, lettuce, egg plants, and cucumbers from south Florida, and at Christmas come strawberries which New Jersey can produce only in May and June. The Florida truck farmer often has a rapid rotation of crops. A typical farmer ships heads of lettuce in January, the ground is immediately set to tomato plants from which the crop is shipped in March, then potatoes are planted for shipment in May, while, through the summer, the velvet bean, a rapidly growing legume of the tropics, makes food for his mules and leaves nitrogen in the soil for the crops of the succeeding winter.

advances northward so does the location of the Next after the supplies of Florida come those Ga., then Charleston, S. C., districts including nds have their turn, followed by New Berne in eastern North Carolina, while Norfolk, Va., running to Washington, Baltimore, Philadelphia, Boston is one of the greatest trucking centers States. This port ships enormous quantities of and strawberries to the northern cities, to be turn by the peninsula between the Chesapeake known as the "Eastern Shore," which, with its navigable bays and estuaries, with railroads as one of the finest systems of transportation finest agricultural districts of the United States. heavy shipments of truck crops from the fields d eastern New Jersey, Long Island, and the ar the New England manufacturing cities.

ture of products of this class gives a great advanducer who can haul the crop to market in his lence there is a much greater concentration of the larger cities, especially within a 30-mile delphia, where good truck land is within easy arket.

of Climate.—The price of the vegetables varies season, indicating that the business is uncertain by the extent of the variation, a perilous one. oducts on the market bring the best returns, ower always aims to be as early as he can and constant danger from the frost, of which the ays hold possible store. A promising harvest ed by frost, such as occurred in late January, 00,000 worth of damage was estimated to have northern Florida. Rains and cool weather in mes retard the development of the plants, causing wo or three great centers to mature at one time re than the market demands, so that the price goes nt where the shipments will not pay the freight.

Industry of Mississippi Valley.—Chicago and the our country draw off-season supplies partly

from certain sandy districts in Tennessee, Mississippi, northeastern Texas, and in southern Texas on the Gulf plain near the mouth of the Rio Grande. In the main, trucking districts duplicate the products of the Atlantic Plain, but the Rio Grande district is developing a specialty of onions.

The California Vegetable Industry.—The open winter of California gives that state an important vegetable industry which probably reaches its highest development on the reclaimed delta lands ("tules") at the mouths of the San Joaquin and Sacramento Rivers. These deltas are especially fine for the production of asparagus, which is grown in vast fields, shipped to the Atlantic states, and also canned. The great drawback of the California trucker is the long distance and high freight rates to the eastern markets. This is less of a deterrant on the dried beans, concentrated and non-perishable, which are grown in great quantities on the semi-arid lands near the sea in southern California.

American Foreign Trade in Vegetables.—The building of a new railroad through the whole length of Florida and out across the coral keys to the island city of Key West, where it connects with car ferries to Havana, promises to give the frost-free fields of Havana a chance to compete easily with the truck districts of the United States which are less favored in this respect. In fact this competition has already been the cause of bitter complaint by Florida growers, who pay more for the carriage of their product from Tampa to Chicago than the Cuban pays for similar freight from Havana to Chicago via Tampa.[1] Porto Rico also exports some vegetables to the United States. Other West Indian and Caribbean regions have excellent resources to produce these crops, but as yet lack marketing facilities, a condition of affairs that was until recently found also in Porto Rico, where the vegetable growers and the steamship lines each waited for the other to begin.

Garden Seed.—The production of garden seeds is a part of the vegetable industry well suited to isolated or distant locations where the marketing of the fresh product is difficult. The

[1]To get the Cuban goods, the road must bid low against New Orleans, and to make up its profits it charges its Tampa shipper a high rate because he has no alternative.

crop is grown largely from seed produced in the Canary Islands, where an important onion as sprung up since 1895 in the isle of Teneriffe. crop of the Atlantic Plain is in large part grown seed. In western Kansas and Nebraska enor- watermelons and squashes are fed to the farm are the chief product of that region) after the ived for the planters of localities more favorably carloads of melons or squashes. On the east and a small locality grows practically all of the own in the United States, while the other end djacent to Brooklyn grows the bulky cabbage cts for the nearby metropolis.

2. THE APPLE

of the Apple Tree in America.—The apple tree ved and, excepting the cherry, the largest of all Its trunk frequently attains a diameter of 2 feet 4 12 feet is known in Pennsylvania). A large tree ice ten to twenty barrels of fruit. From New rth Carolina it is not uncommon to find trees earing at the age of 100 years. The tree is ted to a wider range of soil conditions than any fruit. It grows wild along the fence rows and Nova Scotia to North Carolina and throughout Valley. In the long and humid summer of the not at its best, and is grown only to a limited use. It does well (when the buds are not de- t) on the plains and prairies of the corn belt, degree of perfection in the Ozark Plateau, while and highest-priced apples in America are pro- cky Mountains and north Pacific coast states. rn part of the North Central States the severity s of winter combined with the heat of summer has to make the trees short lived and there are few n survive even for short periods the rigor of that e early settlement of Dakota one man planted of apple trees and seeds each year, getting varie-

ties from all parts of the world, and as a result of many years experiment he found just one apple tree that could resist the winter climate. That survivor has become the parent of most of the apple trees in that part of the country.

There are over 1400 varieties of apples in the United States, most of them of local value only. Some growers manage to have fresh fruit on hand from their own cellars throughout the entire year, and while this is uncommon, apples are now in the market of most cities every day in the whole twelve months.

The Apple as a Supply Crop and as a Money Crop.—In regions where the tree will thrive, a few apple trees for the family supply were until recently a part of the equipment of almost every American farm. The growth of perfect apples is difficult, as is their transportation to market without bruising; the packages are expensive and the fruit has large bulk in proportion to its value, hence the development of apple growing as an industry to supply distant markets is comparatively new. Since we have such a wide territory suitable for apple culture, the origin of apple-shipping districts has been a matter dependent upon some minor advantage of location or upon some pioneer grower showing the people of his locality that this crop could be profitably marketed. Commercial apple growing in America is an important industry in localities as widely separated as Nova Scotia, Ontario, Delaware, Virginia, northern Georgia, Missouri, Michigan, New Mexico, Arkansas, Watsonville, California (near San Francisco), and British Columbia.

Apple Growing in New York and Michigan.—New York is the leading state in commercial apple growing; four counties on the shore of Lake Ontario in western New York have for a number of years been the most important shipping districts in the United States. The Erie Canal and the railroads that followed it gave this region an early advantage of transportation to New York and other eastern markets, and also made low prices for grain and animal products that had been staples there. In addition to this disadvantage for growing staples, and the advantage for apple transport, there is also an advantage in production. The large bodies of water with their melting ice in spring serve to delay the blossoming time until there is small danger of injury from frost. These advantages for apple growing were not fully appre-

er the Civil War, when grain growing had become
ving to the competition from the new, rich, cheap
est. The farmers in New York had to find some
an grain in order to realize satisfactory profits,
trict of the Lake shore plain the alternative was
ie other districts it became dairying. But even
ipples are the chief money crop, there is no county
·chards cover over a tenth of the land surface, a
ig fact, tending to show the rarity of the entire
any locality upon only one crop. The prediction
that within fifty years the south shore of Lake
come one continuous fruit orchard. The present
usiness there and the rapidity of planting and the
v several hundred dollars an acre) of land suitable
ike this prophecy appear reasonable.
ninsula of Michigan is important in the production
asons very similar to those prevailing in western

ylvania and Virginia.—A small field in apples is a
feature of small farms in both Ohio and Penn-
of which states rank high as apple producers, but
hat Virginia has two apple districts with quite as
ion of the land planted in apples as is to be found
of the Rocky Mountains. First, in the Great Val-
and West Virginia not far from the cities of
d Martinsburg is a low ridge called Apple Pie
hich fifty years ago an enthusiast planted a large
which eventually brought him many thousands of
tarted his neighbors to planting apple trees, until
for 25 miles is almost one succession of apple
hey are being extensively planted on the ridges
he Great Valley. Along the eastern slope of the
ountains in central Virginia is another apple
hich large quantities of finely flavored varieties
xported to England. It is said that where the
d Ohio Railroad crosses the Blue Ridge west of
one can walk along the slope of the mountain
l pass continuously from one apple orchard into
her of these Virginia apple districts has any known

advantage either in production or transportation over other territory in the United States where the business has not happened to get started. The same thing may be said of nearly all American fruit localities.

The Open Mississippi Valley and the Ozark Plateau.—On the southern edge of the corn belt in Illinois, northern Missouri, Iowa, and Kansas have been planted some very extensive apple orchards, some of them covering more than a square mile, but the sweeping cold waves that come unimpeded down the open Mississippi Valley have frequently frozen the fruit buds in April and May, and some of these apple districts are not prospering. In the winter of 1910–11 one corn-belt orchard of 64,000 apple trees (1,600 acres) was pulled up because two crops in ten years showed it to be less profitable than corn growing. In the Ozark Mountain region of Missouri and Arkansas, however, an extensive apple culture has developed. About 1880 a pioneer in commercial apple growing planted an apple orchard of 1,400 acres. He took magnificent specimens of the fruit to the World's Exposition at Chicago in 1893 and advertised to the world the virtues of the Ozark Mountains as a place for apple growing. Seven years later, the Census of 1900 showed that Missouri led all the states in the Union in the number of her apple trees. Orchards of from 100 to 1,000 acres in size are common. The rapid extension of the industry was made possible by the very low price of the land in the Ozark plateau and ridges, an old, worn down mountain system ill suited to grain farming, but very well suited to the production of fruit. The elevation and the protection of mountain location causes it to escape many of the freezes that are so destructive to the open plains to the north and east. The crop of the year 1907 was almost entirely obliterated in the open valley from the Appalachians to the Great Plains and from the Ozarks to Canada, but a single Arkansas county in the southern Ozarks, immune from this particular May cold wave, produced over $2,000,000 worth of apples.

The Rocky Mountains and the Northwest.—In the newly settled states of the Rocky Mountains and north Pacific coast there are many irrigated districts that produce beautiful apples. Some of these, as the Hood River Valley in Oregon, the Yakima Valley in Washington, and Delta, Colorado, have already be-

n in the eastern part of the United States through
ruit they send out. Parts of Idaho, Montana,
a few sections of northern California are equally
the growth of this fruit. Because of the bright
semi-arid district, the apples grown here are the
produced in America. The large profits yielded
ds have caused some of them to sell at remarkably
hese western fruit districts, which must be in the
restricted area, because of the limitation imposed
ients, irrigation, water drainage, air drainage, and
strong winds.

e small population of the Rocky Mountain and
the extensive plantings in the irrigated valleys of
depend for their market very largely upon the
and Europe, which subjects them to a heavier
cost than must be borne by their competitors in

f the Apple Industry.—Ordinarily, we grow one
f apples per capita each year in the United States.
e year 1900 was 175 million bushels, of which 39
grown in the three states of New York, Pennsyl-
. That figure proves nothing, owing to the fact
rop of any locality fluctuates constantly from 20 to
f a full crop. An apple tree will rarely bear two
succession and this fact, in combination with
ies by frosts, makes it exceedingly rare that all the
apple districts have a full crop at the same time.
as in the year 1896, the crop exceeds the demand,
almost no value (seventy-five cents per barrel in

Other Pests.—As a result of our world commerce
ction of new varieties of plants, each locality also
of the world's weeds and plant enemies. Thus
ects, fungi, rusts, and other plant enemies which
troy nearly all the fruit that forms on the trees
cted orchard. Fortunately they can usually be
y skillful care, much of which consists in spraying
ds on the trees. This makes the production of
of the most scientific of all pursuits, and is trans-

ferring it from the small orchard of the general farmer to the large orchard of the specialist in the better located fruit districts. This is causing rapid increase in the commerce in the apple which is more generally used by all classes in the United States than in any other country. In the last two decades the sale of apples in country stores in the farming districts has become quite common.

FIG. 77.—Spraying an apple orchard in Virginia with poisonous mist to kill insects. (U. S. Dept. Agr.)

The Effect of Refrigeration.—Under good storage conditions some varieties of apples will keep well for a full year, so that cold-storage warehouses, refrigerator cars, and refrigerator ships have made possible the easy distribution of American apples all over this country, and their export to Europe, and have also made

ıle and use every day in the year. The United ɔrts 1¼ million of barrels each year (1901–1910), nited Kingdom and Germany. A few thousand ·ear are sent to Cuba, Brazil, Mexico, and American countries, where the apple cannot be

listribution of fresh apples has caused a marked ɜ use of dried apples.

ple Growing.—Canada is also an apple exporter at importance as the United States. The apple Lake Huron to the mouth of the St. Lawrence ies have utilized their especial advantages for apple as a money crop for the foreign trade. ɔus of these is the Annapolis Valley in Nova)11 estimated 1,500,000 barrels). This narrow estern part of the Peninsula is protected by the and a sheltering mountain range, and is well pple. These advantages, together with an early t access to the sea coast, and its relative unfitness of agriculture, have given it a development of which has made its product famous in Britain. e is the chief money crop and financial dependence The second Canadian apple district is near ı the peninsula between Lakes Erie and Ontario, he protecting influence of the water similar to ıefits the New York lake shore apple belt, of lly an extension separated only by the Niagara

ple Growing.—Apples are at home in Eurasia ı to the Mediterranean, from the Bay of Biscay to are quite commonly grown throughout western he chief fruit crop in the 200,000 acres of British western Europe does not supply enough for its regions of greatest production on the continent in valleys in the highlands of south Germany, of d of the eastern Alpine regions in Austria. The ıards of Europe are smaller than those of the because of the small size of the farms in all the ɜd apple-growing regions. The total European

production is large and there is a heavy traffic to the cities of Berlin, Paris, and London, and the numerous small towns of the manufacturing districts of the Rhine Valley and the adjacent territories of France, Germany, Holland, Belgium, Switzerland, and Austria. In some cases canal boats are loaded with apples in bulk, taken to the city, and tied up to the bank until the load is sold out to consumers.

In some parts of Germany and near Paris, apples of exceptional quality and local repute are grown under conditions which typify the painstaking methods of the European gardener, fruit grower, and small farmer. When of the finest quality and size, these apples bring the fabulous price of a dollar a pound in the markets of London and Paris. Only a few of them can be grown on each tree, which by careful pruning is sometimes kept in a form resembling the grape vine.

In a recent year a frost happened to destroy all the buds on the trees in one district in the Rhine Valley, and the growers avoided the apparent loss of the crop by methods which could only have been practised by the painstaking gardeners of Europe or the Orient.

From another part of Germany where the buds of this variety had not been destroyed they secured twigs with good buds on them. These twigs were grafted into branches of the frosted trees so that they lived and bloomed. A second branch of the tree was side grafted into the bud-bearing graft to nourish it. By this great care each double graft was made to produce one of the precious apples.

The Apple in Asia.—From Constantinople eastward throughout the central regions of the Asiatic Continent the apple can be grown in almost any location where there is sufficient water, but this must usually be supplied by irrigation, although it grows wild in many mountain districts. The fruit is quite commonly grown by the Chinese farmers of the Upper Yangtse Valley and in all cooler parts of China and to some extent also in Manchuria, Korea, and Japan. Although important in meeting the wants of the local population, it has not in this region of undeveloped transportation become an important article of commerce.

The Apple in the South Temperate Zone.—The south temperate zone, with the reverse arrangement of its seasons, can

utumn fruits to the North at the end of winter
gone or have been longest in storage. The south
has climate and resources that seem well suited
particularly in the Island of Tasmania, which
ge as West Virginia. It much resembles this
xture of mountain and valley, its good rainfall,
lity to the apple, and in its mountain orchards.
a is one-tenth as great as that of Britain. Tas-
are sent to Australia and to a limited extent to
th New Zealand with a similar climate sends
o the British market. The total export from the
phere, however, is small in comparison to that
States and Canada.

also has an apple district and the tree is said to
rts of southern Chili and to be largely grown for
e fine plains near Santiago. It is quite probable
pening of the Panama Canal this district, which
nost as near to New York, Philadelphia, and New
es Italy, will begin to send us apples at the sea-
rees of New York, Virginia, and Washington are
to bloom. Small shipments are already coming
from Cape Colony and Tasmania.

ply and Adaption to Natural Resource.—The
fruits are unlike meat and grain, in which we have
of resource so that greater product means higher
eld of the apple (100 to 800 bushels per acre) is
t of grain. It is capable of being produced on
land of which there is a great deal, especially east
ppi River. Some of the finest apples grown in
rt of the United States are produced on hillsides
te steep and rough. This suggests that as our
omes better adjusted to the geographic conditions
, the hillsides are likely to produce a greater and
tion of our fruit, leaving the level lands for tillage
duction. The large yield from small area (with
) suggests that low prices may be expected, and
is possible. In this respect it belongs distinctly
o, the truck crops and all the other fruits.

3. THE PEACH

The Perishable Nature of the Peach and Its Commercial Effect.—This delicious fruit is regarded as more of a luxury than the apple, chiefly because by its perishable nature it is less adapted to being a staple of commerce. The standard market peaches cannot be kept in good condition more than ten days or two weeks without excessive cost, while some varieties of apples will keep in good cellars from October until June. But such is the high esteem of this fruit that while a few years ago it entered into commerce but little, it is, since the coming of fast trains, refrigerator cars and steamships, marketed all over the United States and Europe and even sent across the ocean. Owing to the perishable nature of the peach there is but one day upon which it can be picked for market. The day before it is too green, a day later it is too soft. A thousand-acre peach orchard must have a perfect succession of varieties so that each day the labor force may be fully employed, from the first ripenings in July to the last in October, when the little army of peach pickers breaks camp and the men disperse to their distant homes. Wide demand, in combination with difficulty of production, gives a high value to the peach and makes it an excellent money crop for the favored localities that can produce and market it successfully.

The Susceptibility of the Tree to Climatic Influence.—The peach tree is apparently a native of Persia, and grows well from the Atlantic coasts of Portugal and Africa to the Pacific coasts of Japan, but like the apple, the peach is nowhere throughout this vast region an important article of commerce except in small sections of Europe. The tree, unlike the apple, yields well only in restricted localities under special climatic conditions. Spring frosts often destroy the buds or young fruit, which requires a warm summer and much sunshine for proper ripening. This condition does not exist in Germany, Holland, Belgium, the north of France or Great Britain, and the tree can only be grown in these countries under the artificial conditions of hot houses or on south side of walls where the tree is trimmed so that it spreads out like a fan against the flat surface, thus catching the direct rays from the sun and the heat reflected from the wall.

settlers brought to the United States varieties
ʼeral centuries been growing against the walls of
A recent discovery by an American professor of
ıws the great dependence of industry, partic-
ılture and fruit growing, upon science. The
orth Europe needed heat and by the strange
environment which plants possess, it gradually

pear trees near Abbotsford, the home of Sir Walter Scott.
and pear trees need to be spread out flat against a south

ish bark, a color which absorbs more heat from
sun than a light color, which reflects more of the
as light clothing reflects heat and is cooler than
ich absorb heat. But by acquiring ability in
rb heat, the peach was fitting itself for destruction
:e over the whole eastern half of the country with
:limate the great danger of the peach is its tend-

ency to bloom in the first warm days of spring and have the blossom or young fruit killed by a subsequent frost. It has been discovered that the red twigs of European varieties get warmer in spring sunshine, bud earlier, and are destroyed oftener than varieties with a light green bark. This has set the plant breeders to searching for green bark varieties of peaches to replace the prevalent red bark ones, so that the tree will be a little less subject to frosts. At best the peach can only become an important money crop in regions somewhat immune from early frost. The United States has at least eight such districts, where an industry is already developed.

The Peach Belts of the Great Lakes.—Two of these localities where peach growing is specialized, and has become an important money crop are furnished by the Great Lakes whose cold water surface makes the cool spring temperature that delays the blooming of the peaches until after the frosts. The peach area is important and rapidly increasing in the part of western New York where apples are important. Some peaches are also grown along the shores of these lakes in southern Ontario, and along the so-called Finger Lakes of central New York.

The second peach belt, determined by the Great Lakes, is on the eastern shore of Lake Michigan where the prevalent west winds, blowing inland from the lake, give the necessary temperature control over a belt, less than ten miles in width, in a latitude where upon the opposite shore of the lake the peach is often not grown at all or is of small importance. The history of peach growing in this Michigan district gives another good example of the dependence of industry upon science. A mysterious and incurable and fatal disease called "the yellows" spreads from peach tree to peach tree. Unchecked it worked destruction in the west Michigan peach belt and reduced the number of trees in one county from 600,000 in 1870 to 30,000 in 1884. This reduced the value of land to $10 or $20 per acre when it had been worth from $50 to $100, and brought communities to the verge of bankruptcy and social disorganization. At this point it was discovered at the State Agricultural Experiment Station that if every tree having the yellows was removed when the disease was first discovered, only one or two per cent. of the trees per year would be killed, and the peach industry could thrive. The

h industry rose again. The county that had but 1890 had over a million in 1906, and throughout prosperity again prevailed. Nearly every farm oney crop of peaches, which are sent in boatgo, and carloads and trainloads to New York, r distant cities.

ake and Allegheny Peach Belts.—The third peach eninsula east of the Chesapeake Bay in the states nd Maryland. Here, upon sandy soil ill suited ain, grass or live stock, and somewhat protected the adjacent waters, arose shortly after the Civil great centralized peach business in the United been discovered within recent years, however, climate of the mountains in the Allegheny Region, the Great Valley, delays the blossoming of the makes an orchardist sure of four crops in five e greater prevalence of frost upon the low penine Chesapeake Bay reduces the average number of bout three in five years. The advantage of the hill s due to two climatic factors. First, the coolness akes a later start in spring growth. The second ost drainage. Cold air is heavier than warm air, ty nights it settles to the lowland where fruit ile the hills are frost free. Due to this advantage ch belt is developing rapidly upon the mountain Blue Ridge and the Alleghenies in the Potomac in southern Pennsylvania, western Maryland, a part of West Virginia. Here are some of the rganized of all agricultural industries. Single comprise from 100 to 500 acres and there are orchards 1,000 acres in extent.

w England Hill Peaches.—The ability of the peach pon mountain tops than upon lowlands has led y that it can be grown upon many of the higher n New England. Consequently prosperous oryielding good crops on the hill tops overlooking t Valley in the state of Connecticut, an area r before known a commercial peach production.

each District.—In the central part of the country

the Ozark ridges furnish some frost protection in a vast plain where cold waves are perilous to the peach. There is an enormous peach production in Arkansas and southwestern Missouri, but the crop seems to be less certain than that of Appalachia or New York.

The Southern Peach Districts.—In all these northern peach belts the main crop is not ready for the market before August. Since the express service has been perfected upon the railroads it has been found possible to grow fine crops of peaches on cotton land in central Georgia and market them in northern cities some weeks before the crops of Maryland, New York or Michigan are ready. Georgia's chief advantage in peach growing is the absence of rival producers rather than surety of production. The uncertainty of the peach as a crop dependence is shown by the uprooting of a 2,100-acre Georgia peach orchard, 1911, and the planting of the land to the more reliable corn and cotton. In the Southwest, in eastern Texas, a seventh peach belt is coming into prominence. This is a counterpart of the Georgia belt and normally supplies the southwestern and central part of the country, but the practical certainty that there will never be a full crop in all of the peach districts at one time causes each peach district have an ever changing place for its product. If one or two districts happen to have a monopoly the profits are very large.

California Peach Growing.—California has the eighth and last peach belt in America. Bordering upon the Pacific Ocean with the prevalent warm westerly winds from that great body of water, this state has a normal oceanic climate free from the cold waves and strong winds that spread over all territory east of the Rocky Mountains. Peaches can, therefore, be raised with fair assurance of getting a crop, but frost destruction is also known there.

Peach orchards are of great extent, and, owing to the perfection of the California methods of picking, packing and shipping, it is, in seasons of short crop in the East, sent to all the larger eastern cities and at times even as far as London. But a full crop in the eastern districts makes it impossible for California growers to pay the transport[1] cost and millions of pounds of the fruit are then dried and canned.

[1] The force of this limiting factor for Pacific Coast fruit growers is shown by a New York market report of August 20, 1911. "The losses to recent shippers of pears and plums from the far West have in some cases been as much as $300 per car."

; care required to successfully market the peach
dency to cause the commercial growing of this
hief occupation of the grower, who must be some-
ialist.

ach Growing.—In England the peach is always
ıxury, the small import into that country coming
ıe south of France, and from Italy. There ap-
good reason why proper development of trans-
ties should not give western Europe a cheap and
ı supply from Spain, Portugal, and North Africa.
export from the United States and Canada shows
an stand the transportation.

n the South Temperate Zone.—The peach does
south temperate zone as it does in the north
. It is said that peach tree wood was for many
he chief sources of wood supply for the city of
in the Argentine Republic, and peaches of ex-
are grown in Chile, South Africa, Australia, and
Thus far, the only country in the south tem-
ıt has been able to market its peaches in Europe
South Africa,[1] whence the British mail steamers
nd March bring small quantities of excellent
ean markets. They are even sent to the United
ıy of them decay in the three to four weeks that
ısit, with the result that they retail at exorbitant
renty-five cents each) and the market is naturally
The improvement in ocean service and the
Panama Canal may lead before many years to
and cheaper transportation of this much prized
rly from the less distant peach region of Chile,
quently enlarged importation in the spring months
frosts still prevail.

CANNING OF FRUITS AND VEGETABLES

g Process and Its Service to Mankind.—The
ing food, which was discovered about the middle

ernment has adopted the policy that has been so successful
Colonies, notably New Zealand, and laid down stringent
the size and kinds of fruits and packages that may be
Government stamp of quality upon them.

of the nineteenth century, consists in hermetically sealing the food product, and then cooking it, often above its boiling-point, to destroy all bacteria. Under these conditions the food keeps almost indefinitely. By 1883 the methods of doing this work had been so improved that machinery did nearly all the work, including the soldering of the cans and even the pasting and trimming of the labels.

Before the coming of railroads and steamboats and the process of canning, a crop of tomatoes could be consumed only within a few miles of the place in which it grew and within a few days from picking time. After transportation by rail and boat was organized and improved, the tomatoes might be carried several hundred miles, but they still had to be consumed within a few days. After the canning process was perfected and developed into an industry, the perishable products of field or orchard could be preserved for consumption at any time within two or three years and in any corner of the world to which they could be cheaply carried. This elimination of the time limit on perishable commodities has revolutionized agriculture in many localities by suddenly giving perishable products access to the world market. The distribution of crops and of production now depend upon geographic and economic conditions which make certain localities best able to produce certain products rather than upon the more artificial conditions that recently compelled their production close to the market of the nearby city.

The importance in consumption is even more marked. Most parts of the world can now have many kinds of cheap foods previously unused or even unknown. The workers in a paper mill in the woods of Maine may now eat the tomatoes and peaches of Maryland, the cherries and apricots of California. The same is true of the gold digger upon the Klondike, of the engineer on the Panama Canal, of the rubber gatherer in the jungles of the Upper Amazon, and the whaler who spends a season in Bering Sea.

The recent discoveries of silver in the cold and inhospitable woods of Upper Ontario have caused the building of a railroad and growth of a mining town at Algoma, but the fact that it is now far beyond the farm line does not prevent this town from having

ply through the aid of canned goods. A century on a voyage of a year or two often came home, all, sick with scurvy, a disease due to underpoor food of insufficient variety. But when s men drifted in the Arctic ice for years in an ach the north pole, they returned in perfect they were nourished with all kinds of canned neats, vegetables, fruits, fruit juices and extracts. re than any other invention since the introducnas made possible the building up of towns and yond the bounds of varied production.

f the Industry.—Practically all classes of food, s, soups, fish, meat and even bread and pudding ved by canning. The canning factories of the repare yearly from 20 to 30 pounds of fruits and each man, woman, and child in the country. getables the tomato is most important, corn nd peas and beans third, while among the fruits , followed by pears, apricots and apples. The s to over a hundred million dollars per year, l in nearly all parts of the United States. Cane scattered in small towns wherever a surplus of available, such as may occur in a truck farm ict. Furthermore it is capable of being operated vely small scale. Owing to the seasonal nature labor is nearly all done in the summer time and mmigrants who flock in from nearby cities for ence of a few weeks or months.

Plain.—Although widely scattered, the canning United States has three distinct belts showing ment than other regions. The first of these op the industry was the Atlantic Plain. Maryter and most important part of the Atlantic istrict, extending from North Carolina to New tion has become important for the same reasons nportant in the shipment of truck crops to the namely, the sandy soil which is exceptionally ables, and not well adapted to the growth of al staples, especially wheat and grain. Maryland

is the leading state partly because it has so much suitable land and partly because of the exceptional transportation facilities which, by centering in Baltimore, have made it the only important city center of the canning industry in the United States. Ordinarily, canneries are located wherever a few farms grow a surplus of any crop. But the ease and safety of navigation on the many far reaching arms of the Chesapeake gives Baltimore remarkable facilities for assembling farm products. They are brought in steamboats from points as far away as Fredericksburg, Richmond, and Norfolk, in Virginia, a great number of places on both sides of the Bay in Maryland, while the Chesapeake and Delaware Canal opens a way for the Baltimore fruit boats to go up the navigable creeks of New Jersey to such towns as Salem and Bridgeton.

The Baltimore canneries have another advantage in the fact that oyster canning gives employment to both labor and equipment in winter season—a cost factor of great importance.

The sandy southern part of Delaware gives that state an importance in the canning industry that is quite disproportionate to its small area. Maryland and Delaware are important also because they are large peach and pear growing and fruit canning states.

The New York, New England, and Lake Region.—New York which is both a great agricultural state and a fruit grower, is the center of the northeastern canning belt, the second region of great importance. This state leads all the others in the canning of apples, pears, and corn. It is rather remarkable that this state and the New England States exceed the corn belt in the canning of corn. It is a peculiar fact that this arises from a handicap rather than from an advantage. Although not the best possible place to produce corn, that crop is the most profitable, all things considered, that many northern places may produce, although other regions have a greater natural fitness for its production. Thus Illinois is vastly superior to New England as a place to grow large crops of corn. The New England summer is almost too cool and short to ripen the grains well. For that reason Maine with a very small corn acreage cans a great deal of corn, since corn for canning does not ripen but is harvested a full month earlier than it could be if sold as ripened

corn for canning is more valuable than common
arket, so that a small sugar corn crop on a New
England farm is as valuable as a larger crop of

hat cool summer that makes of parts of New
n, and Wisconsin second-class corn producers,
rst-class producers of peas which are here exten-
and canned. If the same factory can lengthen
canning several kinds of fruits and vegetables it
ntage through the better utilization of the plant.
at Janesville, Wisconsin begins its season in June
d ends it late in autumn with sauer kraut, and
the following, employing 250 to 300 persons in
n:

ases peas = 600 acres peas.
ases corn = 1200 acres sweet corn.
ed kraut = 300 acres cabbage.
pickles = 900 acres cucumbers, 75,000–100,000 bushels,

tern Ohio is a good example of the specialization
through canning. Near the west end of Lake
y in Sandusky County, it has been found that
np land with its mixture of sand is well suited to
ng, with the result that there now are six large
ctories within 10 miles and 3,000 acres of cabbage
rown.

t.—The most important canning district is Cali-
state has become important from the combined
e climate, excellent for the growth of fruits and
d the great distance from eastern markets which
le to ship in the fresh condition only an uncertain
that the most perfect, of the total crop. This
ly all the apricots, many of the peaches and other
apples and berries, and is very important in the
ed tomatoes, peas, and asparagus. The industry
possibilities in the other Pacific coast states.

ity of Increased Production and of Overproduction.
ities of increase in the production of fruits, vege-
nned goods in the United States are very great.
Atlantic Plain, so admirable for the growth of

small fruits and truck crops, but a small portion is now used and the production is only kept down by the unprofitable low prices which result from the rather frequent overstocking of the market. If, for example, the farmers of the United States could be assured ten or twelve cents a peck for tomatoes at their farms for the next ten years, it is probable that their production would be increased ten-fold, for they are now commonly grown for less than that price and occasionally the crops are so great that the factories cannot handle them and tomatoes rot upon the ground by the hundreds of tons. This is a great deterrant to industry.

Even with the aid of the outlet afforded by canning, the small fruit and vegetable industries yield so enormously that over-production,[1] with its glutted markets and frequent losses, is a

[1] A most convincing illustration comes from Britain which we properly think of as a chronic food importer and jam user. "The light soil of the Blairgowrie (Perthshire, Scotland) district is well adapted to the growing of raspberries and strawberries. In 1900 the strong demand for raspberry pulp for jam manufacture turned attention particularly to the cultivation of this fruit, and new plantations were made. Raspberry growing requires much labor, as well as an abundance of good fertilizer, the annual expenditure for these purposes exceeding $100 per acre. Plantations yield 1 1/2 to 4 tons, or an average of about 2 1/2 tons per acre. Up to 1900 the fruit was grown principally on land leased at the agricultural rate of $5 to $7.50 an acre per annum. The large profits realized led naturally to higher rents, which in 1906 reached $58 per acre for land near the town of Blairgowrie, and $30 per acre farther out. In 1903 the price of raspberries had been as high as $209 per ton, yielding enormous profits to the growers and attracting other horticulturists and farmers into the flourishing industry. In the three succeeding years a profit of $195 to $245 per acre was not uncommon. One plantation showed per acre in that period for one year: Three tons of raspberries, at $136 per ton, $408; expenditures, including rent, $146; net profit, $262. The value of plantations, apart from the land, at full bearing (in the fourth year) a few years ago ranged from $195 to $487 per acre. About 1,000 acres in the district were devoted to raspberries alone, the annual shipments to English jam factories exceeding 2,500 tons.

"Falling prices in 1907 marked the beginning of the decline of the industry. In 1909 the supply largely exceeded the demand, with disastrous results to the growers. Up to 1906 the average price was about $112 per ton. In 1907 it fell to $92.50, in 1908 to $68, and in 1909 to $44. Plantations became unsalable. Many fruit-growing tenants asked proprietors to take over their plantations as they stood (five-year-old bushes), without payment of any kind, and to let them terminate the leases, which were rated at only $24 per acre. In one case a plantation which was bought three years before at $487 per acre was offered at $49. Land rents have fallen about one-half, which may enable the industry to recover in the course of a year or two from its present state of collapse."—U. S. Con. Rep., 1910. This is an admirable description of the agricultural boom—overproduction—glut-cycle which has been repeated with variations of detail thousands of times; for example, blackberries at Hammonton, New Jersey, 1895–96.

like frost, is ever in the mind of the producer and
lly visits each locality of varied production.
ade In Canned Fruits and Vegetables.—Canned
getables are an important export from the United
eat Britain and many other countries. England
important manufacturer of preserved fruits—pre-
ruits so rich in sugar that they will keep without
ain brands of English jams and preserves made
s grown in the south of England and even on the
urope are known throughout the world, are widely
cially to British colonies and are extensively con-
ain where bread and jam is a favorite article of

lities of the production of canned fruits in the
uch greater even than that of canned vegetables
States, although little has as yet been done in this
nned pineapples are produced by Chinese labor
management in the Strait Settlements, at and near
l exported to Europe and even to America. More
ndustry has sprung up in Hawaii, where Chinese
laborers predominate, and the product is widely
er the United States.

5. DRIED FRUITS

g of the Industry to Lands with a Dry Summer.—
ning of steam transportation, when each locality
t extent upon the local resources and the farmer's
most entirely upon the products of its own farm,
fruits in humid America and Europe was almost
their production. The only other methods of
were the then expensive ones of preserving them
andy or of pickling them in vinegar, which latter
of them merely a condiment. Steam transporta-
l commerce have worked a quick revolution by
arge traffic in dried fruits from those parts of the
nusually favorable conditions for their production.

, and especially marmalade, are found upon every Brit-
and public, and are always served with afternoon tea."—
February 17, 1911.)

It has become easier to dry fruit in the sunny and rainless summer of countries having the Mediterranean type of climate and ship it great distances than to combat the difficulties of drying it at home with artificial heat in evaporators. The only exception to this is the drying of apples, an industry suffering from the competition of the commerce in fresh fruit, and still

FIG. 79.—A rainless summer helps to locate the dried fruit industry by permitting it to be dried upon trays in the orchard. (U. S. Dept. Agr.)

most extensively carried in the eastern apple districts, especially New York, from which state thousands of barrels of dried apples are sent to Europe, chiefly to Germany, Holland, and Belgium, where they are used for food and for the making of wine. From some isolated farming districts in the Appalachian Moun-

southern and eastern parts of the United States, mall shipment of dried peaches, apples, cherries blackberries laboriously prepared over the kitchen ays in the sun, but the humid climate and the h occasional showers blacken these products so g a low price in the market.

ny grocery store in the United States to-day, prunes, apricots, peaches, dates, raisins, figs, and be seen, and the names and addresses stamped ill show that they have come into these American om many distant parts of the world, but nearly istricts with a long dry summer, in which fruit ys beside the trees is dried by the constant sun- at ease and no labor except piling the trays and on those rare occasions when rain threatens.

of California with South Europe.—Californian dominate in the list of addresses on dried-fruit h thirty years ago the labels usually showed es. These industries grew up first in southern ave very recently come to southern California, ve developed with surprising rapidity and now the entire home market and a surplus of some xport. One of the first of California dried-fruit mpete with Europe was the prune, which has rted from several Mediterranean districts, chiefly Tours is the best known center of prune production. d in prune production, and Germany produces e consumption. The recent large export to the has almost entirely ceased, and European fruit depend chiefly upon the European market, to n prunes now go in years of European crop short- arison with canned fruit, the dried fruit has the of becoming wormy in summer, but it is much rated and easily transported. Prunes in large from California in steamships around Cape Horn nipment across the Isthmus of Tehuantepec in ven by rail from California to New Orleans, and forwarding to the eastern states and Europe.

has for centuries been an export of Almeria in

eastern Spain, where the peasants for generations have kept vineyards and dried the grapes. Sultana raisins, produced from a seedless variety of grape, are produced on the eastern Mediterranean, the chief center being Smyrna, with other centers of productions upon islands in the Ægean Sea, and to a

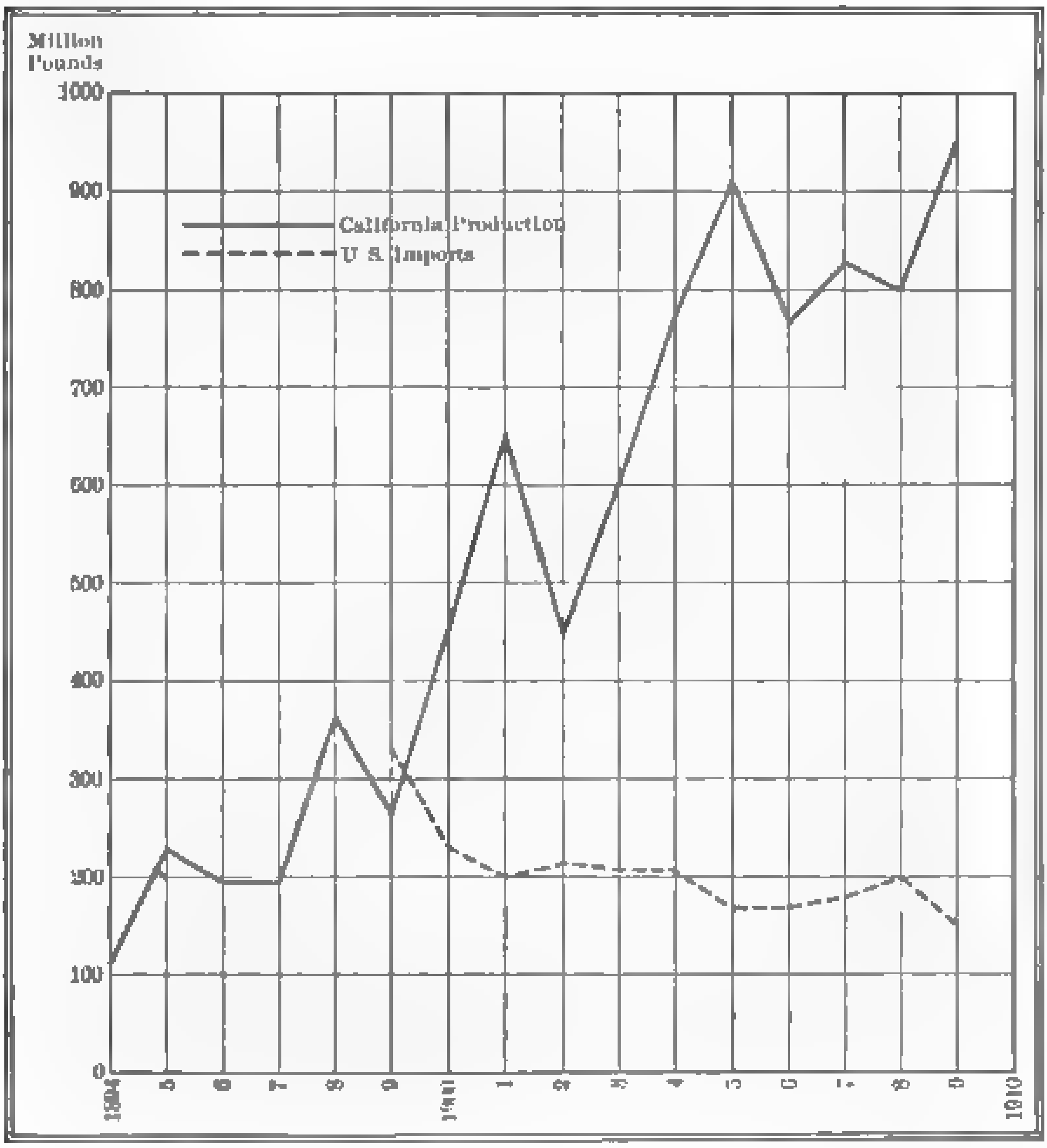


FIG. 80.—United States production and imports of citron fruits.

less extent in Greece itself. In 1880 the United States took 1,200,000 boxes of Malaga raisins alone and in 1909 the total United States import of Spanish raisins amounted to 72,000 boxes—in 1911, 32,000—such is the influence of the California raisin industry upon our import trade.

ot and Its New Significance in Russian Central
pricot is a close cousin of the peach which it re-
l physical features, but because of early blooming,
ensitive to frost, and fruits regularly only in
h good frost protection. In the United States
crop only in California, which state produces
pply the whole country with dried apricots and a
s during the early months of summer. Some are
both fresh and dried. It is also grown in northern
he dried fruit transferred by caravans over the
erilous Himalayas to Thibet and western China,
duct is greatly prized.
unities of central Asia afford a good example of
dry climate, and good transportation facilities on
ustry. The Russian Government, since its con-
ral Asia, has built a railroad connecting the Black
Caspian and the Caspian steamers connect at the
novodsk with another railroad that crosses the
oases of Bokhara and Samarkand. These are
ed communities living upon irrigated lands where
y the snows upon central Asian mountains permit
arms to spread over a few square miles of the level
newly conquered cities on the oases are among the
ents in the world. Before Rome was built caravans
ent, but their commerce had always comprised
t valuable products, like metal work, fibers and
and tea, until the cheaper rates on the new Russian
a new commercial horizon and made it possible
ns to become in part the California of the Russian
hin a few years dried apricots which had been a
ply for milleniums became an important export.
Commercially the fig is a subtropic product but
dier than the orange, grows over most of southern
ven survives in sheltered places in England, Texas,
rts of the Southern United States, but the growing
ccessfully established in California only at the end
nth century. For many years the trees had grown
no fruit because of the absence of a certain insect
Mediterranean lands, and crawls into the hollow

results are very promising especially in Arizona. It is possible that the American imports of these Old World desert fruits will share the fate that has met our import trade in prunes, raisins, and apricots, of which we now export a surplus, which amounted in 1911 to prunes, $3,300,000; raisins, $1,000,000; apricots, $2,100,000.

FIG. 82.—Olive orchard in Salt River Valley, Arizona. (Photo U. S. Dept. Agr.)

Each Continent has a Natural Dried Fruit District.—Since each continent has its region of summer drought and irrigation, there is prospect of world competition in dried fruits as other countries of the world become better developed. In the Australian state of Victoria, for example, the well-known irrigation Colony of Mildura on the Murray River has under irrigation a quarter million acres of land under the same kind of arid climate that prevails in California, Spain, and Asia Minor, and the people are already producing dried prunes, dried peaches, dried apricots, dried currants, and raisins for the Australian

occasionally exporting to Great Britain, where with the products of the Mediterranean countries .

a is engaged to a limited extent in producing the while Chile has her California on the plains and near Valparaiso and Santiago. Over the Andes ilean orchards are the foot hill settlements of San

irrigation of four-year-old apple trees at Wenatchee, Washington. (U. S. Dept. Agr.)

idoza in Argentina producing raisins, dried fruit, hat country. The South Americans have as yet worth mentioning in export, but, as in Africa and e natural resources are there, awaiting the labor husbandman.

6. THE CITROUS FRUITS

ty of Transporting Tropic Fruits.—The citrous the orange, the lemon, the lime, the grapefruit or

pomelo, and several others of small commercial importance, are the advance guard of the tropic fruit supply. People of the north temperate zone are enabled to transport these fruits because of the tough, thick, oily and bitter skin which serves as an effective protection against insects, bruises and decay, while a host of delicious tropic fruits remain practically unknown to commerce because they lack such natural protection and could not enter commerce until recently.[1] It is now possible to bring many of these tender tropic fruits to temperate zone cities and the chief deterrent of large traffic is the lack of demand resulting from our ignorance of them. The natural conservatism with regard to new articles of diet is surprisingly strong, but may be expected to diminish and permit the gradual introduction to our markets of many new southern fruits. The alligator pear and the Japanese persimmon and the mango,[2] good examples of this, are already arriving in small quantities.

The Orange.—The orange is a native of southern Asia, possibly China, where as in India it has been used for many centuries. It was brought by the Portuguese to Europe in 1458, became the basis of an important industry there, as it has become within recent years in the United States. The orange grows throughout the tropics and on the edges of both temperate zones, and is everywhere much prized by the inhabitants of those lands. Like many other fruits it produces its finest fruits near the colder limit of its production, so that the fruit of the United States is superior to that of the West Indies. It is to be had at almost all seasons of the year, since an orange tree carries ripe fruit and green fruit at the same time that it is in blossom. Its wide distribution makes possible an almost unlimited production, but inasmuch as the fruit is quite bulky and its commercial handling expensive it, like the banana, can only enter into commerce in large quantities where transportation facilities are of the best. Consequently, while it is important in commerce, the world's great supply is from a few localities readily

[1] The recent successful import into Germany from Kamerun of fresh pineapple packed in peat dust is very suggestive.

[2] The mango, a delicious fruit as much used in the tropics as we use the apple and peach, is cultivated in India to the extent of a hundred named varieties. Being more durable than the peach we could easily get them from Cuba if the demand existed.

the world's great markets. It is quite certain
nges waste beneath the tropic orange trees than
the people of the north temperate zone. This
ntly occurs even in such nearby places as Jamaica
West Indian Islands, whence "it appears almost
get a profitable outlet for oranges except in the
ks of the season" (U. S. Com. Rept., Oct. 7, 1910).
ges could, however, come to the United States
merican tariff. In Paraguay, a country far up
iver, north of Argentine Republic, oranges are
for fattening hogs, and it is only from the dis-
to steamboat landings on the banks of the great
y are exported down the stream to Argentine
Uraguay. These countries have in Paraguay
rden spot whence they derive, as does Pennsyl-
rida, fruits and vegetables of a warmer clime.

In the Mediterranean Countries.—It is in the
countries that the citrous fruits give rise to the
erce. There, the combined warming influences
ranean Sea, the Sahara Desert, and the Atlantic
ese the most northerly of all regions with climate
for these fruits. A short distance away are the
ple of northern and western Europe, connected
e lands of the South by steamer and numerous

is found on the west coast of Portugal as far as
range districts skirt the southern and eastern
berian Peninsula, but the interior is too high and
it except in the plain of Andalusia.

mportant Spanish orange-growing district is on
he Gulf of Valencia, near the central part of the
The steamship lines that skirt this coast carry
at Britain half the orange supply used in that
h British marmalade is made of Spanish oranges
of Holland manufacture a drink called curacao
of the bitter orange which is grown for this pur-

nce of Islands in European Citrous Fruit Grow-
n islands that the growing of citrous fruits seems

to reach its most extensive development by Europe, chiefly because the surrounding waters afford frost protection. The Azores have long been important shippers of oranges. Orange production is probably more important to the Balearic Islands than to any other part of the Spanish territory. Malta has long been known for the excellence of its oranges, while in Sicily and the neighboring shores of Calabria we have the greatest development of the Italian orange and lemon industry. This industry is quite as important to Italy as it is to Spain, Italy possessing an orange or lemon tree for every two persons in the whole country. Although the orange reaches its highest northern latitude for the world, 44°, on the protected coast of Italy not far from Genoa, it is not important north of Rome, and the lemon, being more susceptible to cold, will not grow north of Rome at all. Sicily greatly predominates over the mainland in the products of both these fruits, having almost a monopoly of the production of lemons, whence they have for a century been distributed to the lemon-consuming regions of Europe and America. The Italian and Sicilian peasants give these fruits the greatest care. South of Naples they can only be grown in those few spots that can be irrigated. The ground is usually cultivated with the hoe and the spade, garden crops are often grown between the trees, and much of the soil is so steep that it is kept from washing into the Mediterranean only by the laborious building of terraces restrained by stone walls. It is chiefly this intensive kind of agricultural industry that has given to rugged and arid Sicily a population of 300 persons to the square mile.

Africa and Asia.—France receives a large part of her orange supply from the African colony of Algiers, the chief center of production being near the port of Oran. With the exception of the Barbary States, all Africa seems to be beyond the limits of orange transportation under present conditions of production, although there are large areas where it grows. A few Asiatic oranges go to England from Jaffa on the Syrian coast and from southern Japan a few come to the United States, otherwise Asia, the native home of the orange, has almost no foreign commerce in it, although it grows from the Mediterranean to the China seas.

port into the United States.—This country began
iges from Italy and Sicily (where the industry
established) about 1835 when the American
vere perfected to great speed. With the develop-
amship this import became large and regular and
also participated in the supply, the chief sources
by Bahama Islands and the British colony of
ntly the home production has almost ended the
United States.

e of Railroads and Cold Waves in Florida Orange
ween 1880 and 1890, when through railroads
the south it was discovered that Florida could
nd ship them to northern states. This was the
e American commercial orange industry which
d to other Gulf states. The product of this
is excellent, but the orange growers have had
rith the occasional cold waves coming from the
ontinent and bringing freezing temperatures to
and to nearly all of Florida. If not in rapid
ime, the orange tree can resist some frost, but the
he Gulf climate may make the tree grow
time during the winter and as a result frosts
practically all the orange groves that have
a large scale in Louisiana, Mississippi, Alabama,
nd the frost of January 1, 1894, was almost a
nity to Florida. The industry had previously
le in Florida although not in other Gulf states.
had been made, some of them were coming
d the crop was about doubling each year. On
, a single cold morning altered the prospects of
ing practically all the orange trees in the northern
insula and bankrupting many of the growers.
ewed and despite occasional injury to crop and
ees, there has been no other such destruction as
Many growers now protect their orchards with

in a heavy shipper of oranges and by 1911 the
ween our two orange-growing regions had become
onishing freeze over the whole of the California

citrous fruit belt in January, 1913, had not been duplicated in 40 years. The loss of fruit, estimated at from $20,000,000 to $40,000,000, tends to even up the competition between the two regions.

The Grapefruit and West Indian Orange Growing.—Recently there has been placed upon the market the grapefruit, a citrous fruit first shipped from Florida. Its pungent, bitter flavor is causing a rapid increase in its use and production.

The fear of frost destruction in Florida caused a boom in orange planting in Cuba in the few years immediately after 1899 when Cuba became independent. Orange and grapefruit groves were planted, chiefly by Americans, at an expense of $10,000,000, but the Cuban grapefruit is said to be sweet and therefore not so desirable as that of Florida, while the tariff and shipping costs leave so little money for the Cuban growers that there seems to be small prospect of large orange shipments from that island to the United States, or to Europe with its Mediterranean supply. The Cuban orange, seems, like the Jamaican orange, destined to lie upon the ground rather than enter into foreign trade unless calamities overtake Florida and California, or the manufacture of orange products takes unwonted strides.

California Oranges.—Florida's misfortune in 1894 proved to be California's advantage. The northern limit of the orange in Florida is about 30° north latitude while, in California, owing to the oceanic climate of the Pacific Coast, the tree grows as far north as 37° near San Francisco. However, the region in which the industry has had nearly all of its large development is south and west of the coast range in southern California. Here the cold wave of the Mississippi Valley is unknown and the danger of a destructive freeze is much smaller than in Florida, although frosts that destroy the crop are not uncommon in many localities. The high prices of oranges after the destruction of the Florida crop in 1894 led to large planting in California where the orange is grown with the most perfect care on irrigated land of high value, the orchards often being valued at $1,000 and more per acre. This very high value is due not to scarcity of land but to scarcity of water, which amounts to scarcity of orange land, since unirrigated lands cannot grow fruit. Great

to get and save water for the irrigation of the orchards. Tunnels are sometimes dug back in strike the underground flow, wells are dug and water to the land where it is sometimes carried t around the base of each tree so that the smallest at may make an acre prosperous. The great

n of Arizona citrous fruit tree by the basin method, econom-al of water. (U. S. Reclamation Service.)

he eastern market has made transportation costs ly the best fruit can be shipped. To attend to he fruit growers have formed associations which les of cooperative enterprise. They ship thou-ls (above 40,000 in 1910) to Chicago, New York, distribution throughout the East.

ern part of the California citrous district the

lemon is now being extensively grown for the American market, but our import of about $3,000,000 per year, almost entirely from Sicily, shows that the home supply is well under the demand.

Our Declining Orange Import and Possible Export.—The development of the two American orange belts cut down our imports 50 per cent. between 1904 and 1908, and those of 1910 were less than a third as great as those of 1908. The small quantities that we still import come from Jamaica, Cuba, Honduras, Mexico, Spain, Italy, and Japan. The steamship lines from Italy that once carried hundreds of thousands of boxes of oranges and lemons now come with a scanty cargo of lemons, but often full of emigrants getting away from over-peopled Italy. It is likely that in a short time we will reach the position of an orange exporter and develop strong competition between Florida and California. Florida has more danger from frosts, and, owing to her moist climate, has more fungus diseases which at times injure the trees, but she is nearer to the market in the great centers of population of the East and makes the claim that her oranges are juicier and that her grape fruits are better than those of California. The professor of Horticulture in the University of California states that California is using for oranges only one-tenth of her suitable orange land. Florida, with but 12 per cent. of her area in cultivation, with only fourteen persons to the square mile, an abundant rainfall, and about half of her area in reclaimable swamp of great fertility, has a much higher ratio of possible expansion than has California. The comparison of Florida with Sicily is even more striking. Florida is nearly all level and capable of tillage, Sicily very hilly and rocky; Florida well watered, Sicily dependent upon irrigation for all important crops but wheat and possessing twenty-five times Florida's population per square mile.

Manifestly the limit of orange production in the United States is to be set, not by resources, but by prices. Unchecked production in Florida and California can easily produce the same low price that prevails in the tropics where oranges lie unused on the ground. The citrous fruit market is easy to glut, as shown by the shipment of 800,000 boxes from Sicily to the United States in three months in 1895, when the price went down to

ure that it only paid shipping costs and duty—a faced the Cuban orange shippers in 1909.

—The lime, excepting the new kumquat, the commercial members of the citrous family, seems the tropics, the chief supply coming from the . The leading producer is the little island of which the people, since the decline of the sugar given great attention to the production of the s well suited to the steep, rocky limestone and. Here are plantations and factories owned candy manufacturing firms of Europe who nice for the preparation of candies, and sell citrate ne oil for use in the preparation of drinks, medi-ne commercial products. The neighboring island also produces limes.

7. THE GRAPE

Requirements of the Vine.—The grape is con-ury wherever it can be obtained, being a delicious rial for the much prized wine. These two factors d with its importance in classic lands to make most celebrated of fruits. The vine is indigenous nited States and from Hungary to Afghanistan Grape seeds are to be found in the remains of the ellings dating back to the bronze age, but it is the Old World industry as we now know it began western Asia. Old Testament references to the w its high antiquity among the Hebrews. The y introduced among the Greeks and Romans and oughout the world wherever the climate and soil cultivation and even beyond the natural climatic rge quantities of most delicious and expensive duced in the hot houses of England, Holland, and

quisite for the grape is a summer of considerable to September. The vine sends its roots to great thus search out water in arid soil and will thrive s when surrounding vegetation is brown and dead.

Thus, it grows in southern Italy without irrigation on the hills above the orange groves. In California where irrigation must be used for many other fruits and crops, the grape crop is usually grown without any artificial watering whatever, even in some localities where there is no rain from blossoming time until harvest time. Accordingly, the grape is at home upon the edge of the world's sub-tropic belt in each of the three continents of the northern and southern hemispheres. Too much moisture is detrimental, producing fungi which attack and destroy both the leaves and the fruit. Thus the monsoon climate of India, China, and Japan with its great summer rain makes extensive grape growing impossible. Often under the best of conditions fungi sometimes appear and work great damage, as the fungus called the "odium," which has practically destroyed the vineyards of the Madeira Islands and worked great havoc in other parts of the world.

The Limits of Grape Growing.—Although the grape is grown on the sheltered Channel Islands, the line marking the limit of the industry on the mainland is curved from the west coast of France near the mouth of the River Loire northward to latitude 53° in east Germany. This northward trend is due to the increasing heat of the summer as we go eastward from the moderating influence of the ocean into the greater heat of the continental summer. In Russia the summers, though hot, are shorter and the grape line descends to the Sea of Azof and thence runs eastward through south Russia and Asia. In America, there is a similar bend of the grape limit from 37° north in California to 40° in south Ontario where the lake belt gives grape growing a northward extension. In the southern hemisphere grapes grow in the chief centers of population in Australia, South Africa, and temperate South America. Before the coming of the present extensive and easy commerce in wine, grapes were grown and wine was important in the valley of the Severn in England, and in parts of Germany above the present line, but the quality was poor, the harvest uncertain, and the industry is now limited to districts of more favorable climate.

Importance and Difficulty of Transplanting the Industry.—Grape growing and wine making reach their greatest importance as a national industry in France, Italy, and Spain—countries

e five-sixths of the world's wine. Other countries
are Austria, Russia, Switzerland, and the United
the three leading European countries have long
e wine industry of the world and have held their
spite vine growing and the effort to introduce
into many other parts of the world. The industry
ve. In the first place it is an intensive industry
lense population. Like a garden crop it requires
produce the grapes. The yield is great, in France
lons of wine per acre. In the second place, expen-
s and much labor are required for the fermentation
ito good wine, and great skill is required to get the
s in the product. Lastly, wines are sold by the
country or place producing them, as Burgundy,
ampagne, etc., and a long time is required to
reputation. If the growers of Burgundy wine
ome other part of the world, they could not be sure
ould find the proper soil and climate to produce
dy, for few crops are so affected by the soil, the
l the temperature as is the grape. If the people
ly made wine as good as Burgundy in Cali-
stralia, it would take them two generations to
fact and get the price. But there is no guarantee
ians could make Burgundy wine in a foreign land.
soil influence, particular varieties of grapes are often
row localities, a conspicuous example of this being
the vine grown in Greece and producing the fruit
erce under the name of dried currant. This im-
fruit is the best cared for of all the crops of Greece,
al product is 150,000 tons a year. The half of
rop that is exported makes up about half of the
of Greece. The currant grape, because of pecul-
and climate, is produced only on certain islands
ertain part of the Gulf of Corinth, from which the
is derived.

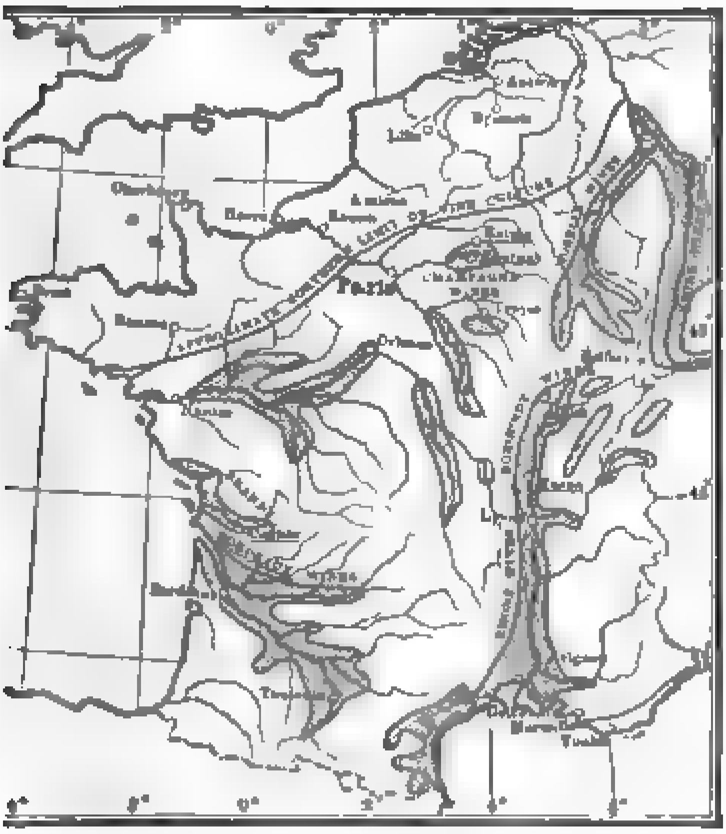
Wine Industry.—Italy depends more upon grapes
wing than does any other nation. While her wine
unately, so highly prized as that from some other
ly nevertheless exports great quantities of it.

The limestone hills and dry summer permit the grape to thrive better than most other crops, and they are grown in all parts of the country. Vineyards cover not less than 15,000 square miles of territory or about one-seventh the entire area of the kingdom, one-sixth of all used ground, and one-half as much land as all the grain crops combined. These figures become more significant in comparison with the corn crop of the United States, which covers about one-seventeenth the area of the country.

French Wine Industry.—France is the leader of wine-producing countries, and her people consume on the average at least 25 gallons of wine per capita per year. While the grape area is only one-half that of Italy, the yield is greater than Italy's, a measure of the superiority of French land and rainfall and agricultural methods. The French grape crop covers only one-eighth the area given to the grains and although it does not extend into the northwestern part of the country, the wine-growing province of Champagne reaches the Belgian boundary. The good esteem of French wines, among them claret, burgundy, and champagne, makes wine, after textiles, the chief export of the country. Her foreign commerce and prosperity depend to so great an extent on this trade that a calamity to grape growing is a national calamity. Such was the Philloxera, an insect pest which came from America to Europe, where it spread through all the wine-growing countries, thence to Algeria, and finally reached South Africa, Australia, and South America. The Philloxera, a tiny insect of the aphis family, gets upon the roots of the grape vine and sucks the juices from them until the vine is killed. No cure has been found, and France, which had nearly 6 million acres in the vine in 1875, had less than 2 million acres of healthy vine in 1885, and another million acres invaded by the Philloxera. The only thing which prevented the practical extermination of grape and wine growing throughout the world was the fact that in America, the home of the Philloxera, there were varieties of grape immune to its attacks. These were imported to Europe, set out by millions in the vineyards which the Philloxera had devastated and tops of the European varieties were grafted upon their roots, making a composite plant with American root to resist the destroying insect and a European top to produce the desired wine grape. Thus, the industry rose

t the present time, France has three-fourths as vines as she had in 1875 and the yield is four- as at that time.

sh wines are consumed wherever throughout the ple wish to drink the best of wine, the French large wine importers, taking practically the entire , which is one-seventh as great as that of France, so large quantities from Italy and Spain. Some-



rine-producing areas of France. Names of wine and brandy centers underscored. (After Brigham.)

their own high priced wines and use the cheaper and Spain for home consumption. Much of the er, they mix with native wines and flavor, label, French wines. They even import as much as unds per year of the dried currants (grapes) from are manufactured into wine for export. Germany hese currants for the purpose of enlarging the hoice brands of wine.

dustry of politically German Alsace is French in od. The French province of Alsace was annexed fter the war of 1870–71 and has become the lead-

ing wine state of the German Empire, having about 77,000 acres of vineyards. It employed one person per acre and yielded over $40 per acre in 1909, thus showing the suitability of the

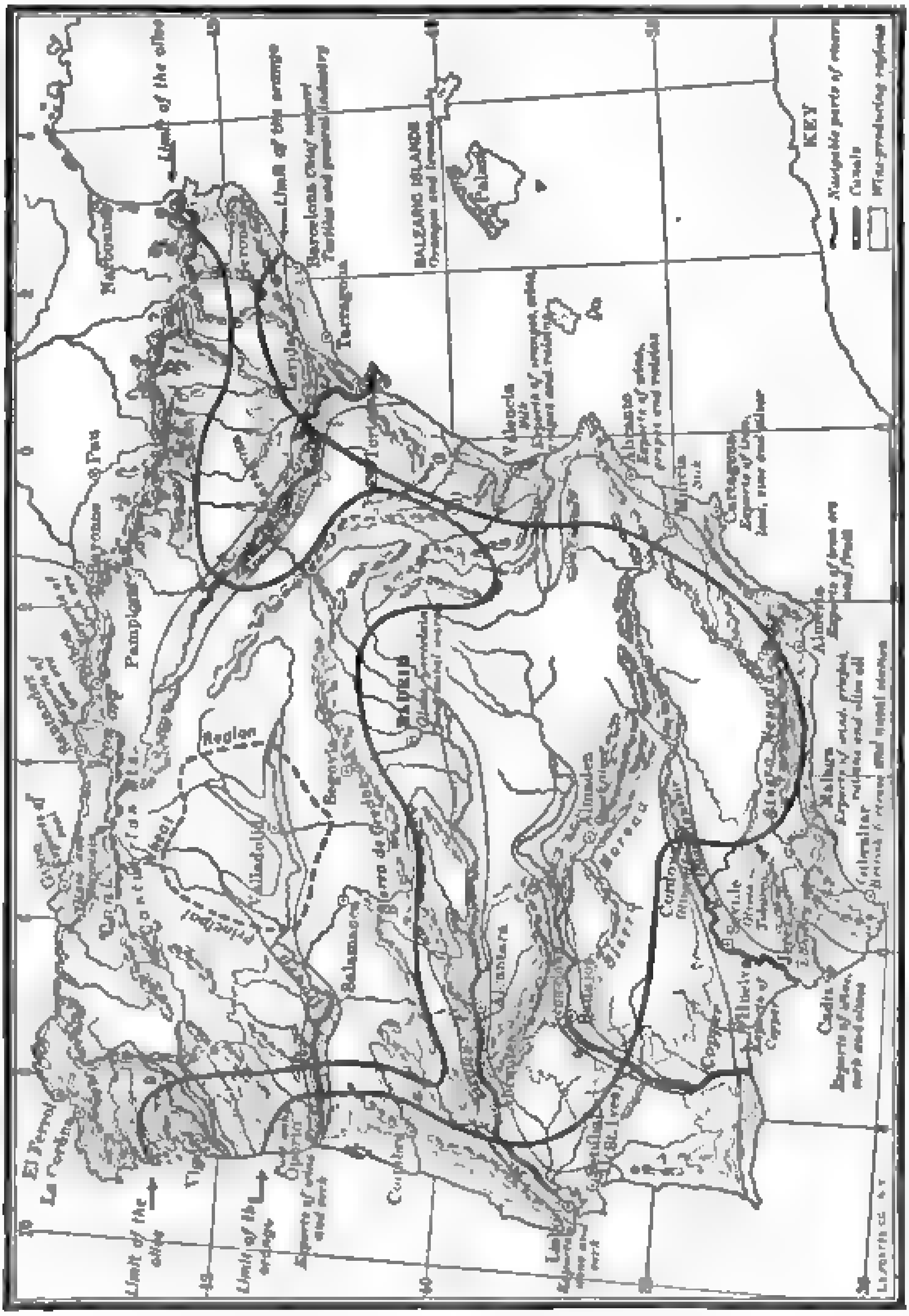


FIG. 86.—Iberian Peninsula—production centers and influence of plateau and sea upon them. (After Brigham.)

industry to dense populations, for the wheat crop of the United States for the same year was worth $15.64 per acre.

Spanish Grape and Wine Industry.—Spain, the third great

country of the world, is also a grape exporter, ;land, especially from Malaga and other south- nost of the 3 to 4 million dollars' worth of grapes each year imports. In 1891, before the Philloxera ›rk in Spain, wine made up one-third of the export ıtry, but now the proportion is somewhat less. ı of Spanish wines is the "sherry" which, since the peare, has been exported from Jerez de Frontera, Cadiz. Jerez has been corrupted into "sherry." h resembles Spain in people, resources, climate, has one-tenth of its cultivated land in vineyards, h goes chiefly to Great Britain and Brazil makes ore of the exports of the kingdom. Port wine Oporto) is the leading brand.

pe Growing in Europe.—In the northern parts an grape belt the desired heat and sunshine can by planting the vineyards on the southward s. In this way they are protected from the north osed, by the inclination, to the practically direct ı, and often get in addition the reflected sunshine urface of the Rhine, the Moselle, and the Swiss s means Switzerland has become a wine producer, slopes overlooking Lake Geneva and the other ut the total, aided by a higher yield per acre, is of France. Germany, with a production one- f France, is probably the best example of hillside . The most famous of the German districts are p south slopes that come down to the Rhine, and , the Neckar and the Moselle.

rds upon these riverside slopes prosper in latitudes ise they would scarcely exist. Some of the Rhine been in grapes continuously for centuries, and so have certain brands of wine become that new been built from time to time in places so forbidding ng wall had first to be built and earth carried up r bank (often by women), before the vines could One particular mountain slope near Bingen pro- st famous Johannesberger wine and is valued at re, the equivalent of $33 per front foot for a build-

ing lot 185 feet deep. These terraces, so steep that horses cannot be used, are cultivated entirely by hand, even to the carrying up of baskets of manure, strapped upon the backs of men and women. So dense is the population of these districts and so great the pressure upon resources that when the green ends of the vines are cut off in August to hasten the ripening

FIG. 87.—Stone walls hold the earth in Rhine slope vineyards worth $7000 per acre. Tower and castle of mediæval barons who lived by their exactions from Rhine traders. Freeing the Rhine was one of the great steps in modernizing Germany.

of crops, they are carefully saved and fed to the goats, and when the vines are trimmed in winter the cuttings are sold for fuel.

Owing to the scarcity of land, terrace vineyards are common on Italian hills and mountains. Nearly 200 terraces, one above the other, may be seen on the southern slope of the Apennines, near Lucca.

Vine Growing to New Countries.—There have been ts to establish wine growing in other countries, s already stated the progress has been surprisingly consider the vast areas in North and South America, Australia, and Asia that are probably just as well e making as is Europe. The growth of sheep, ains springs up in a new country in a decade, but f capital, labor, and skill required for making wine, th the even greater handicap of a new brand, ree original wine-growing countries overwhelm- inant. The colonies and frontiers may produce d meat, as for decades they have done, but all of f Great Britain combined do not produce one-half of the world's wine. Roumania and Russia, pos- ense population to supply the necessary labor, reater progress in the last thirty years than any ate of increase (400 per cent. between 1880 and nia has led all other countries except the United he wine districts of southwestern Russia, adjacent , are increasing rapidly and in 1897 exported a reat Britain for the first time. Grapes thrive in Minor, Syria, Persia, Turkestan, and other parts nd interior Asia, where travellers and explorers d them of excellent quality and of local use, but a basis for any commerce.

-Australia has large vine-growing areas near her nd it is admitted that the product of certain vine- ria is practically as good as any wine in the world. s also produced in the adjacent states of south n New South Wales, the farmers have been driven ing because the droughts, although they ruin the t prevent a crop of grapes. Owing to the sparse Australia, however, its production is insignificant. h would stimulate production, still labors under that the reputation of Australian wines has still

ca.—South Africa claims to have, in the western Colony near Cape Town, just the right conditions ne, and moisture to make it the best grape-growing

region in the world. The Dutch settlers succeeded well with French and Rhenish vines, and in 1822 this region sent more wine to England than did France. The fungus and insect pests of the nineteenth century, however, have kept the industry down and the present production, though greater than that of Australia, is small. The government has recently made attempts to foster the industry, and the present small output is no index of the future. The ripening of the fruit in the springtime, when we have nothing but expensive hot house products in northern latitudes, causes the export of some fine grapes to Great Britain along with the peaches and plums previously mentioned.

South America.—South America has its grape districts upon the edges of the desert belt which cuts diagonally across the continent from northern Chile to southern Argentine Republic, between the eastern rain belt of the trade winds and the western rain belt of the westerlies. Chile is a large consumer of wine, the crop of 1909 amounting to 15 gallons per capita. This was grown on 159,000 acres, an area half as large as the German vineyard area, and located in the northern part of the great valley of Chile, a region supporting most of the agriculture and population of that country, and greatly resembling the valley of California in all respects. Near Santiago there is a splendid plain given over to intensive culture by irrigation and to the growth of grapes which are made into a wine of local fame. Chile has a small export of wine but, as from all other new wine regions, she has to meet the difficulty of convincing wine users that her output is as good as the established brands of Europe.

In Argentine Republic the chief grape and fruit districts are dominated by French wine growers in the irrigated settlements of Mendoza and San Juan, watered by snow-fed streams from the nearby Andes and separated from the agricultural plains of the east by some hundreds of miles of level sheep and cattle ranges. Special trains carry fruit and a large part of the wine to Buenos Ayres, the largest city in the south temperate zone and in population a rival to Philadelphia. The value of the Argentine wine crop has reached $12,000,000 in one year. Uruguay also has some wine production, but like that upon the coast settlements of the Peruvian desert plain, it simply serves a local need. Some

ine is imported by every country of South America, ry indeed, throughout the world where white men numbers.

owing in the United States.—When the European ded upon the shores of the United States and stocked s with the plants and trees of Europe they were id that all the grape vines promptly died from some ind of blight that destroyed the leaves. It was new g in the heat and humidity of the eastern American nies to which the plant had never been subjected in rope or dry south Europe. Yet the colonists found ican forests wild grape vines growing to prodigious g to the tops of the tallest trees and often reaching of half a foot or even more. From this stock of the eastern part of the United States have in es evolved a number of varieties of edible and of their names, Concord, Clinton, Niagara, Delaware, atawba, Early Ohio, etc., showing their American

now two widely separated centers of commercial g in the United States: The eastern, near the Great the western, in California. The grape is widely ghout the eastern and southern parts of the country crop, but the cold waves of the continental climate te spring frosts make it uncertain as a money crop calities where water bodies give frost protection. r, the eastern grape belt lies close to the shores of a lesser extent to those of Lake Ontario, and to the orth and south lakes of New York, called the Finger vineyards of the Finger Lake district are upon the western slopes of the hills along the eastern shores the prevalent west winds blowing across the waters ing the desired temperature. The fact that New possesses the Finger Lakes and touches the two Ontario and Erie, gives it leadership in eastern g, while Ohio with a long stretch on Lake Erie is Pennsylvania with one county on the lake is third. e southeastern shore of Lake Erie, especially on ls in the lake and even on the Canadian lee shore,

the grape field is much the most important field upon the farm and is often the entire dependence of the grower. The grapes of this eastern district are chiefly of the Concord and Niagara varieties which are much prized as table grapes and are widely shipped to the cities, small towns, and country districts of eastern and central states. They are far cheaper, sweeter, and also more generally liked than the edible grapes of central Europe.

California, with her Mediterranean climate, has become a second Mediterranean country in other respects than as a producer of citrous and dried fruits. The climate has attracted Italian and Swiss vine growers who have formed colonies and grow the European grapes which thrive in this part of America.

Two hundred and fifty thousand acres of land usually level and mostly in the great valley are devoted to grapes with a yield per acre greater[1] than that of any other region in the world. California grapes of European varieties are sent all over the eastern part of the United States, where they are sold at a price much higher than the Lake Erie grapes. Wine manufacture has been taken up with considerable success, and some of the product is exported, although the choice brands of Europe are far above it in reputation and price.

Wine growing yields a commercial by-product of a character one would little expect, namely, argols or wine lees, the settlings in the wine vat or cask, of which we import over two million dollars' worth per year for the manufacture of cream of tartar, baking powder, and other drugs.

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CHAPTER VII

SUGAR

Source and History of Sugar.—Nearly all plants have it in their sap at some time in their growth so there are many sources of sugar. Many plants store sugar which can be used in other seasons, just as other plants store and use starch. All fruits have some sugar, the grape being especially rich, and a considerable portion of sugar is even found in the onion. The more important of the sugar-storing plants are beets, carrots, and parsnips, which hoard it for use in the second year of their growth to make their heavy top, blossom and seed. In the tropical zone the date palm, Palmyra palm, and coconut palm, are all used to some extent for sugar manufacture in the lands of their growth. The American Indian got sugar from maple trees. The sugar cane, a plant much resembling an earless stalk of corn filled with sweet juice, grows throughout the moister parts of the tropics and in its natural condition was so superior to other sugar yielders that it was practically the only source of commercial sugar supply until the nineteenth century. An exception should be made for the primeval sugar supply of honey (the sugar of blossoms), which was much more important in past centuries than it is since other sources of sugar have been developed.

The general and heavy use of sugar among temperate zone people is recent and it has rapidly passed from luxury to a necessity. In 1589 a pound of sugar cost as much as a quarter of veal. In 1700, 50,000 tons per year were used in all countries of Europe. At the present time, that quantity lasts the United States about five days. Within the last century there has been a seven-fold increase in the world's commerce in sugar, and the people of the world are using more and more per capita each year.

tion of the Sugar Beet.—Sugar is one of the few in which there is competition in production between te zones and the tropic regions. During the last there has been a strong competition between cane- ers and beet-sugar producers, and it will doubtless decades to come.

ibly due to the Napoleonic Wars that the beet has at source of sugar supply. The military and com- :ades of these wars cut off France and often the rest om the cane-sugar supply of tropic colonies. At Napoleon French scientists examined hundreds the search for a promising sugar supply. Among ape and the beet, were most seriously considered heir high contents of sugar, but industrial effort lf upon the beet which, the Germans first used in 306 the French government offered a bounty for roduction, and in 1811 Napoleon ordered 80,000 s to be grown for sugar. Only one sugar factory Napoleonic Wars and the renewed competition the industry lingered along until finally by the nineteenth century it had become firmly established. ugar industry affords us one of the best examples e that science renders to man. In 1836 it took f beets to make a pound of sugar; in 1882 about ifficed; in 1904 less than 7 pounds yielded a pound 'his great improvement has been brought about rmany, where on large sugar plantations trained en doctors of philosophy and chemistry, devote their improving the sugar content of the beets. Samples the most promising roots and tested; the best e saved to produce seed the next year, and so on for fter generation, always selecting the best. This rstematic selection has, within the life span of the sugar content of beets and along with improve- process of sugar extraction, made possible one of ricultural industries of the temperate zone. The ıprovement has not yet ended. The per cent. of eet crop of the United States rose from 14.8 per cent. cent. between 1901 and 1910. In eight years the

percentage of sugar extracted rose from 10.95 per cent. to 12.56 per cent.—14 per cent. increase in the amount of sugar produced per ton.

Climatic Requirement and European Development of the Beet-sugar Industry.—While the beet will grow in a very wide range of territory from the tropic nearly to the Arctic, the conditions for beet-sugar production are exacting—a moderate amount of spring and summer rain and a summer of moderate heat, but not too hot, and a cool, dry autumn. Corn-growing climates, for example, are in the main too warm in mid-summer, but as the cool climates of England and Sweden suffice, it is plain that corn and sugar beets are rare competitors. Irrigation, especially in America, gives the best conditions for beet growing and this rarely suits corn. In Europe the best region for beets is the great northern plain from Normandy to central Russia. Germany is the leading producer and, in 1900, so great had the industry become that 60 per cent. of the German product was exported. Germany and Belgium began to export shortly after 1870, Russia in 1888, France in 1889, and Holland in 1895. Spain depended entirely upon the sugar from Cuba and the Philippines while she ruled them, but after losing these possessions in 1898, she began at once to grow sugar beets in her northern provinces with such astonishing rapidity that her local production rose from 2 million pounds in 1896 to 113 million in 1899, and 207 million in 1903, when the import of foreign sugar practically ceased. Southern Sweden and southern Denmark have also taken up the industry, but have not yet become sugar exporters.

Relation of Sugar-beet Growing to Intensive Agriculture.—The growth of the sugar beet is an intensive agricultural industry. It can be prosecuted only in fertile mellow soil, rich in lime, and neither too clayey nor too sandy, finely prepared, and plowed so deeply that a sub-soil plow must often follow the ordinary plow. Caring for the crop is most laborious because of the large amount of hand labor required. The young plant is so small that only human fingers can rescue it from the up-springing weeds, so that men, women, and children, especially women and children, go into the fields in nearly all beet regions, including the United States, and spend days upon their knees weeding

eets. A little later, when the plants have become
hey must be thinned out with the hoe. Thus far
of machinery have been unable to replace either
s of hand labor.

plant is established there must be many cultiva-
the late autumn the beets are plowed out of the
ie tops pulled off. The roots are then piled, covered
nd sometimes with earth, until delivered to fac-
on, train, or boat throughout the winter months.

n and children weeding a sugar-beet field, western United States. (U S. Dept. Agr.)

ir factory to be economical must be large, costing
ars or more. The beets are ground to pieces, the
out of them in hot water, and finally crystallized
.e refinery to be put into final form. It is common
beet-sugar factories to have refineries also.

ducts of the beet field serve to enhance greatly
of this crop in the intensive agriculture of a
ntry. The leaves and tops of the beets are worth
or cattle food, $4.50 to $5.75 per acre, which makes
comparison with the $9.37 which was the farm
verage acre of wheat in the United States for ten
905.

agriculture of any of the large nations, is a heavy exporter, yet the table of various acreages and their percentage of the tilled land shows that but 2 per cent. of the German farm is in beets, while potatoes, the main crop of all Germany, occupy six times as much, and rye more than thirteen times as much.

European Centers of Production.—The map of beet production in Europe shows that while its growth is scattered throughout central Europe from northwestern Spain to Moscow, there are four centers of importance. The greatest is in central Germany, near Magdeburg, where beets occupy from one-tenth to one-seventh of all the cultivated land. Here the beet fields spread in great expanses over the level, perfectly tilled plains and while the peasant children pull weeds, their mothers may be seen plowing the beets, using at times the family cow for a draft animal. During the winter the manufacture of the sugar occupies much of the laboring population and the by-products help to feed the animals on the farms. This district is well situated for export of sugar because it is on the navigable Elbe, which carries nine-tenths of the traffic in this territory.

The beet region of Holland, Belgium, and the north of France between Paris and the English Channel is economically one region separated only by imaginary political boundaries across which the beets are freely passed to the nearest factories without tax or duty.

Northern Austria, in the plains around Prague, also on the navigable Elbe, has the greatest intensity of beet culture in all Europe. In southwestern Russia a large part of the level plain centering in the Kief district, is a beet section where, although the yield is only about half that of Germany and their sugar content lower, beets are extensively grown. Within the ten years from 1892 to 1902, the Russian share of European sugar production increased from 13 to 23 per cent.

Governmental Influence and the Brussels Conference.—The sugar industry is one to which governments have given much attention and about which many laws for both protection and taxation have been made. In many countries the sugar industry exists only by the special privilege of government protection. Throughout central Europe sugar is generally high in price

actically all the producing nations have a protective eep out foreign sugar and in addition an excise or f several cents a pound on sugar. Thus, in 1902, the cise tax was two cents and the French tax five and one-ts per pound. The consequent high prices lowered umption. England, which has no tax on sugar and ır price is therefore the cheapest in the world, had in ;ar consumption of 90 pounds per person; that of the ıtes with a two cent tax[1] was 71; while the Russians ırds ate one-sixth as much, the French one-fourth, the ess than a half, and the Italians but a tenth. When ction in Germany, Austria, and other countries of .s greater than the consumption, they could not with-l it in foreign countries until after the excise tax had been the government. For example, the German manu-ho paid his excise of two cents per pound, could not ;han three cents per pound for his sugar in England, m one cent for the sugar unless the government re- excise upon the exported sugar. This the government o encourage the foreign trade, the export refund or k" was usually larger than the excise, and, therefore, a bounty on export sugar.

ustry was further complicated by the formation of ıts by the refiners in Germany and other countries. ıers' trusts raised the price to the people of the home ınd because of large profits from this source could ɜll the surplus abroad at exceedingly low prices. When France, Austria-Hungary, Holland, Belgium, and :e thus partly paying for the exported sugar, it became ve business for those governments, but one from which :eat importing countries, United States and England, ›fited. These bounties so stimulated production on ıent of Europe that surpluses of sugar accumulated ɔmpetition with cane sugar became so keen that the gar producing colonies of Jamaica, the other West ınds and Guiana suffered great depression through the ·ice of sugar. To protect her colonies, England threat-

ted States has had for many years an import duty of two re per pound.

ened to lay on all sugar imported into that country a tax that would just equal the bounty that it had received in the export country. This would benefit the British treasury at the direct

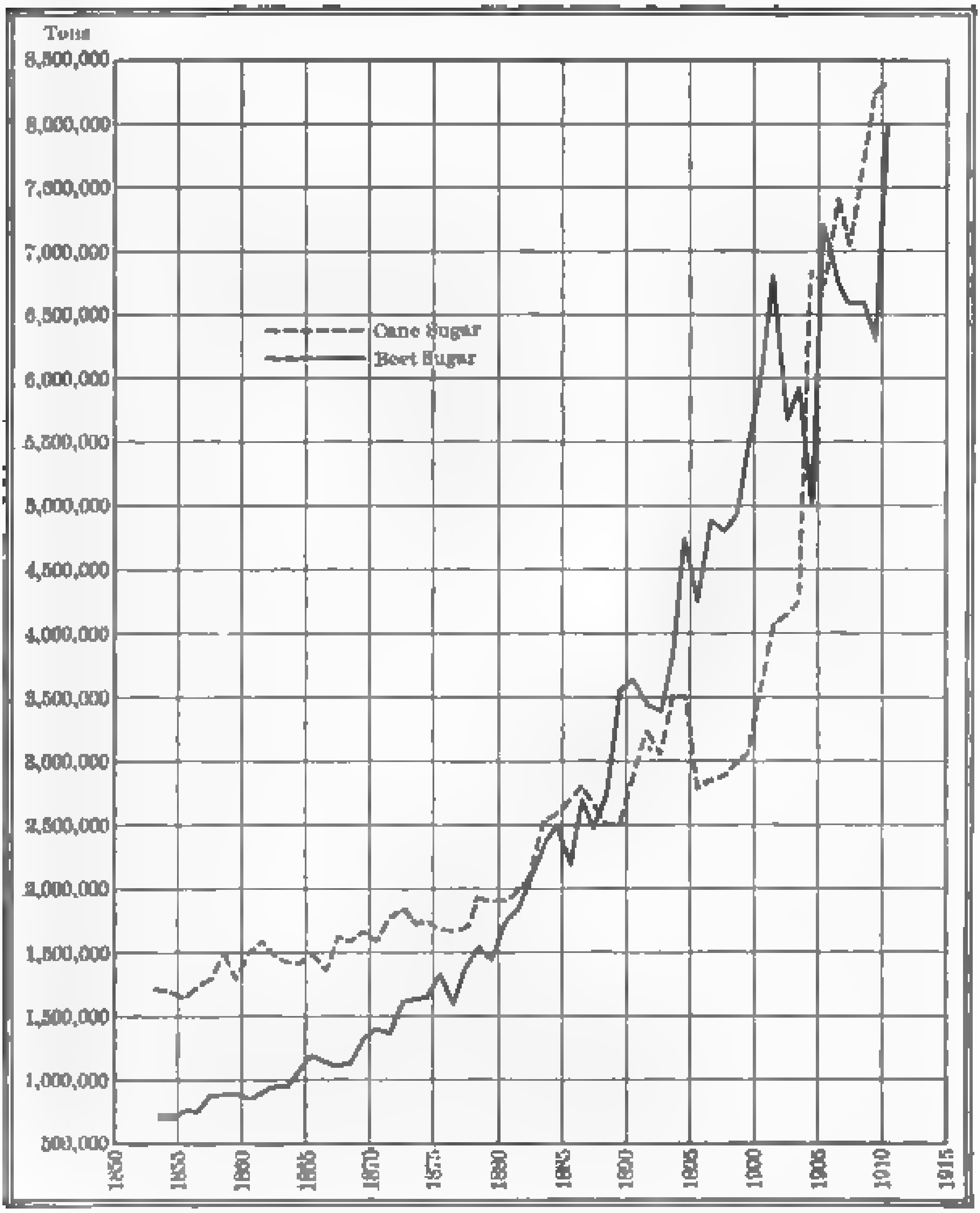


FIG. 90.—World production of cane and beet sugar, 1853–54 to 1910–11.

expense of continental treasuries and to seek means of relief, a sugar convention was called at Brussels in 1901 and 1902, at which most of the European countries agreed to stop all export bounties whatever. As a result the world's sugar export went

a more normal basis. The removal of export bounties
e prices in exporting countries and raised it in import-
ies. Thus England saved her colonies from the com-
sugar made cheap by export bounty and the people
wing countries had for the first time cheap sugar for
umption. This made instant increase in consump-
et-growing countries. In Germany it increased 50
n a year and in France it nearly doubled.

tion of Beet and Cane.—During the fifty years before
ls convention the proportion of beet sugar had in-
m 14 per cent. of the total world production to 64
ut the revival of the cane industry in Cuba and the
nting of beets in Europe, after the Brussels conven-
d it to fall to 58 per cent. in three years and in the six
wing the Brussels Convention, beet-sugar production
00,000 tons, while cane sugar increased a million tons,
iderable concern of sugar growers of Europe.

the four years 1908–11, the world's average produc-
e sugar exceeded that of beet sugar.

ar Growing in the United States.—As a natural
e labor and climate required, the sugar-beet industry
its establishment in the United States, although we
land resources for it. We had a production of but
in 1890, but, stimulated by a high tariff made price, it
),000 tons and passed the cane crop in 1906, and the pro-
still increasing, the crop of 1911 having exceeded
ns. The possible beet area of the United States is
es as large as the possible cane area, and seems to
er closely the July isotherm of 70° which traverses
length of California, thence to Utah, down the west
Rocky Mountains to central New Mexico, thence
ky Mountain front through Colorado, Wyoming, and
then bending above the corn belt, passes eastward
Dakotas, Minnesota, Wisconsin, Michigan, Ontario,
o and Albany to Portland, Maine.

r beet thus offers a money crop to the American
hose regions where the climate is a little too cool for
m development of corn.

with its heavy labor requirements did not interest

the American farmer while corn land was still to be had for the taking. It had its practical beginning in the early nineties, 110,000 acres were grown in 1899, 292,000 acres in 1903, and 470,000 acres in 1911. The relative importance to some American localities is as great as in any part of Germany. Thus, Eddy County, New Mexico, had 15 per cent. of the improved land in beets, while Bay County, Michigan, had 13, and Ventura County, California, and Spokane County, Washington, had 6 per cent. each.

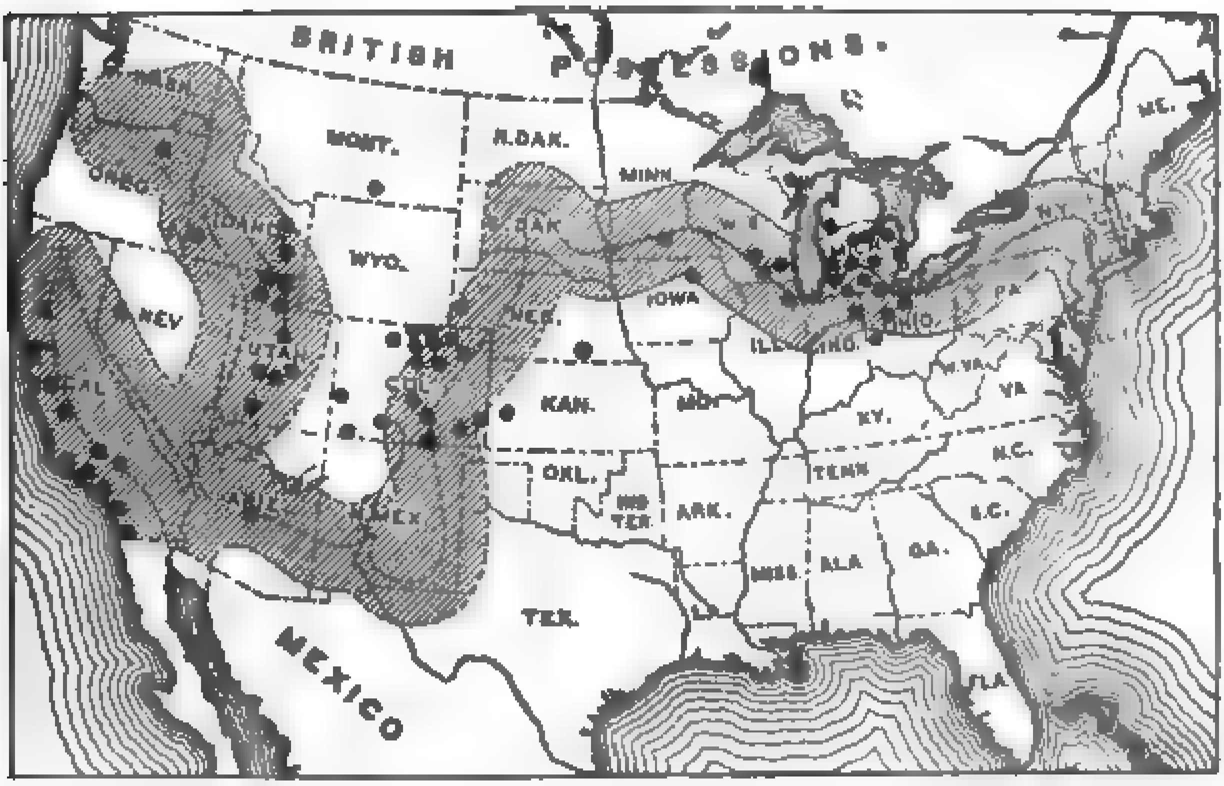
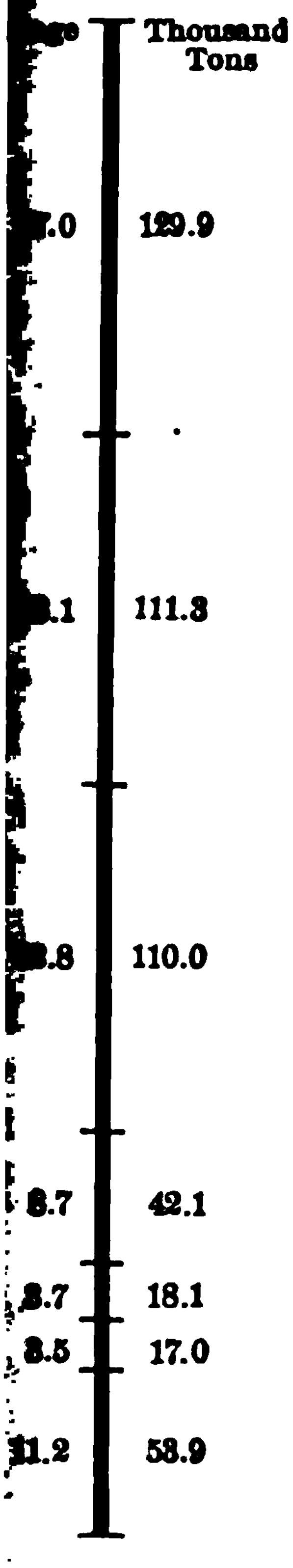


FIG. 91.—The line through the shaded area is the July Isotherm of 70°F. The shaded area shows the zone in which the sugar beet grows best and the dots indicate the location of the beet-sugar refineries in the United States.

It is quite common in the beet-growing districts of the United States for the hand labor to be done on contract by newly arrived immigrants. A peasant from Roumania, Hungary, or Poland, accustomed to the growth of beets, and to a low standard of living, will contract at so much per acre to take care of the beet fields. With the assistance of his wife and children he then takes entire charge of the crop for the American farmer. The intensive character, large labor cost, mellow soil requirements and high yield of beet growing fit it especially to irrigated land. Irrigation also insures the dry October, a month in

ains can do so much injury to the beets. The these factors gives more than one center of beet each of the four irrigation states of California, ho, and Utah. The adaptation of the beet to d sandy soil makes it important in Michigan and



d States beet-sugar ree-year average, to 1911-12.

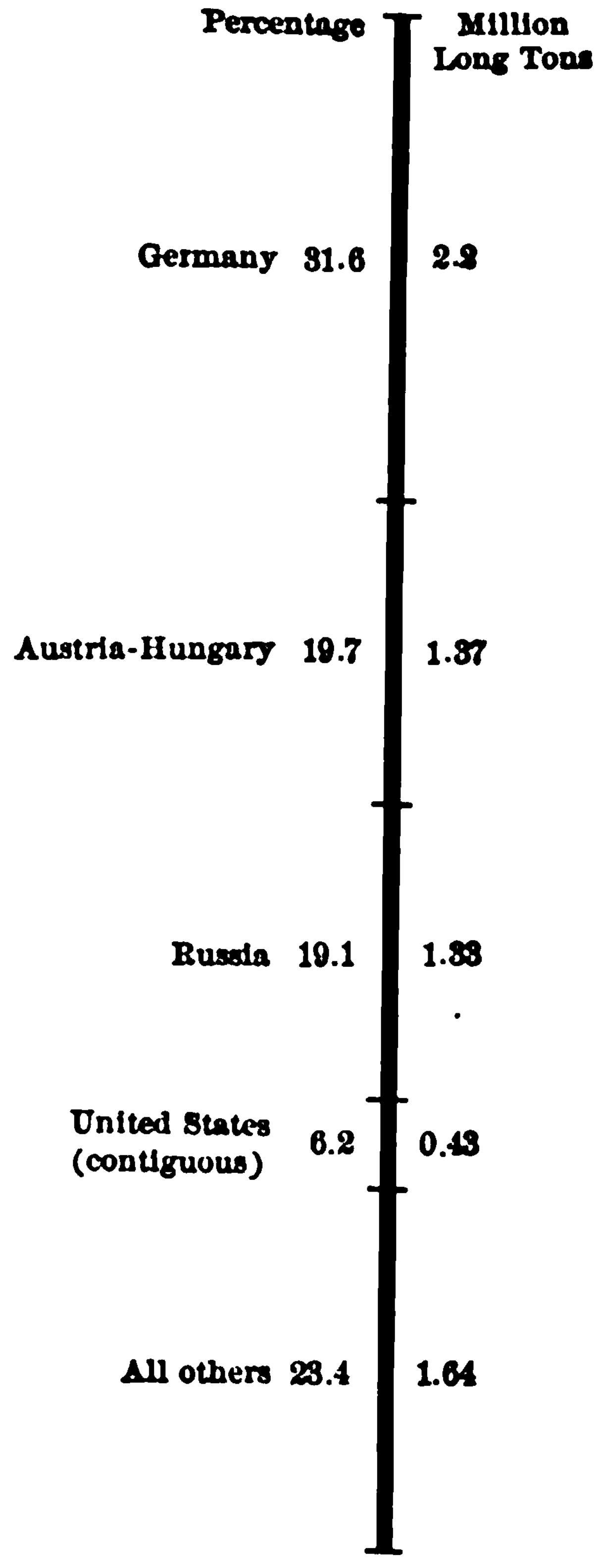


FIG. 93.—World production of beet sugar, three-year average, 1908–09 to 1911.

tent in Wisconsin on the glacial areas too far north not well suited to grass. New York and Ohio are rn margin of beet growing and have one beet-sugar

for extracting the sugar from beets is so large and

costly that it requires hundreds of acres of beets to keep one running through the fall and winter season, and it must run for many years to be profitable to the owners. Hence it is to their interest to encourage beet growing and in America, as in Germany, the sugar manufacturer, through contracts with the farmer, controls the crop rotation, the method of beet growing and, to the community's benefit, becomes virtually a teacher of agriculture.

Climatic Requirements, Harvesting, and Distribution of Sugar Cane.—The battle between cane and beet is carried on at long range, the plants themselves never meet. The sugar cane is as distinctly limited to warm climates as beet is to cool ones. It will grow on the edges of the temperate zones in such districts as Louisiana, Natal, New Zealand, and Cape Colony, and has been grown at 32° north latitude in Spain and 31° south in New Zealand, but it is at home and does its best only where free from frost. It invades the frost zone only where there is a long growing season, and freedom from competition, as by tariffs and bounties. The best crops require such conditions as exist in Cuba, Java, Brazil, and India, where there is a temperature of 75 or 80° F. the year round and a rainfall of 60 inches or its equivalent by irrigation. The necessity of much sunshine gives irrigation a great advantage.

THE GROWING OF CANE

Cane does not require such careful handwork as the beet. It is cultivated with plows, not hoes; by men, not by women and children; and even the steam plow may do much of the work, as has been proved in the British island of Trinidad and in Hawaii. The method of planting consists in putting cuttings in the ground, or, as in Louisiana and Cuba, in laying in the bottom of a furrow a row of cane stalks which sprout up from every joint. After eight months' or more growth and cultivation the leaves are stripped off, and the stalks are cut by hand because no machine has been found to do it, and carried away to the factory. The transport of the cane to the factory is a serious problem. A good crop is 15 or 20 tons per acre. The fields are often muddy and the distance to the factory is increasing with the

factory, which is large. In backward countries, etimes carried on mule back, but in the great shipping arts drawn by oxen or mules are used, while the best pped plantations have portable railway track placed in and diminutive plantation locomotives to pull the Cane resembles beet-sugar making in the size of the ired to economically extract the juice and dispose products. Several thousand acres of cane make a The guaranteeing of this amount of cane year after ficult if many independent tropic farmers must be ipon. This tends to make the sugar company grow its -a process that is much easier than the growing of corporation on a huge scale. Thus we find in the province of Jujuy one of the leading plantations of ry employing (1911) 5,160 workers (of whom 4,520 is at thirty cents per day for women, and forty cents men), with 19 miles of permanent railway, 19 miles ry railway, 600 cars, and seven locomotives. Cane a far less scientific agriculture than is beet growing. ations in Cuba and even in the United States are g the crop year after year on the same ground without rop rotation. As this cannot continue indefinitely, hment of crop rotation will require larger area and difficulty of carrying cane to the mills.

ribution of Cane Growing.—The adaptation of the to practically all moist lowlands lying between id Argentina in the New World and between southern ıdia, Natal and Queensland in the Old World, gives rce of sugar to all tropic peoples. Cane growing is stry in practically all such countries, although only em export it, because, while a crude ox-driven mill o crush the cane for local use, it cannot compete in ıarket. In India, for example, it is estimated that ınnual production of over 2 million tons, more than r country, but it does not enter into foreign com-se all this and more is consumed locally.

e is grown in the lowlands of Mexico and of each ral American countries, and also in every South untry except Chile. But throughout most of this

region the process of manufacture is crude, the conditions of transportation, of labor, and of capital are unsuitable for the development of a large cane-sugar export, although there are in tropic America large areas of excellent cane land. This is especially true on the shores where the trade wind blows. The lowlands of the Caribbean, coast of Mexico, and Central America are excellent examples of such lands.

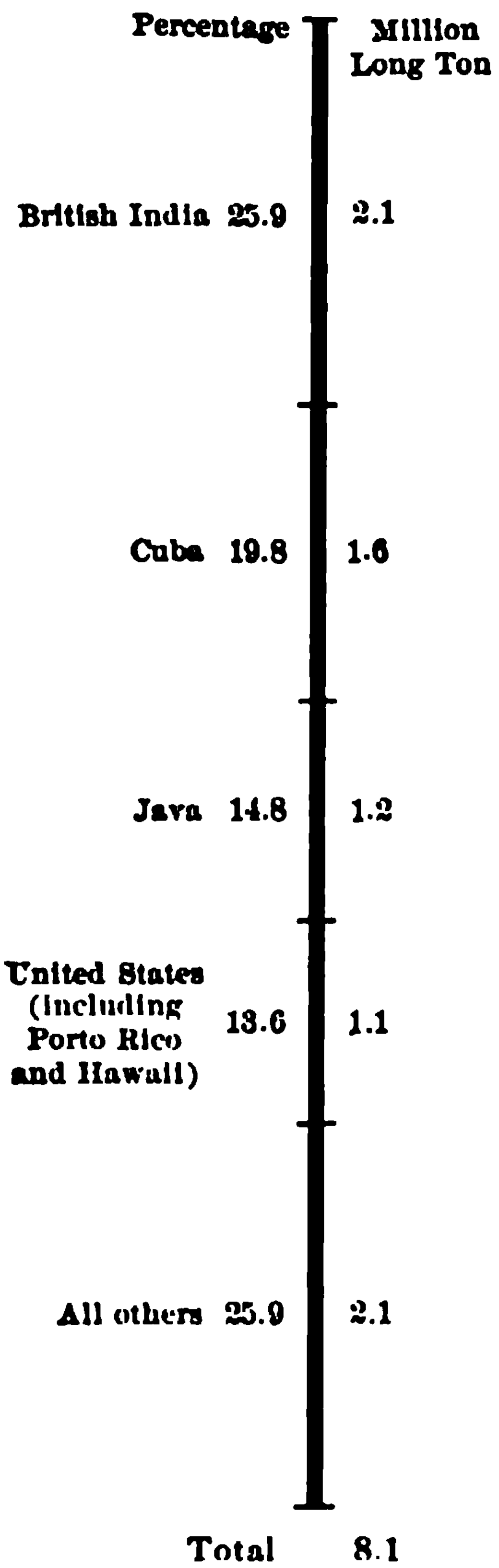


FIG. 94.—Production of cane sugar, three-year average, 1908–09 to 1910–11.

The export supply of cane sugar comes only from especially rich plains and favored tropical shores, such as Cuba, Java, the Philippines, Hawaii, and Brazil.

At no place is cane sugar grown for export in locations distant from the seashore and from ocean transportation.

Sugar Export from the Mainland of North and South America.—The only export of cane sugar from the North American continent is a little from Nicaragua at times between the intervals of chaos accompanying the frequent civil wars. South America has three sugar exporters, each producing under distinctly different conditions.

The British Colony of Guiana on the northeast coast of South America is one of the most interesting of cane-sugar producers, showing intensive cultivation and the untouched wilderness side by side. Large areas of coast swamp have been reclaimed from the sea along the north shore in the same way the Dutch (the original settlers of Guiana) have done in Holland. This is the more unusual because most of the country remains a great forest absolutely uninhabited, save for a few uncounted savages. The explanation of this unused land is to be found in the climate which is so ill suited to white colonists that they number but 5 per cent. of the total popula-

rely occupy positions under the government and in
ment of stores and plantations. In the attempt to
fertile desert and work the productive lands, the
has permitted the recent importation of thousands
ian coolies accustomed to growing rice and sugar cane.
d to the rapid increase of rice growing along with
ance of sugar-cane growing which has been for many
nain export product of this colony. The reclaimed
l is very fertile, has a large rainfall, and, in addition
l level dyke lands, are easily irrigated for both sugar
Further than that the drainage ditches serve as canals
ts that carry cane from field to factory.

st to the capitalistic and highly scientific sugar in-
Guiana, Brazil has a sugar industry whose methods
changed in a century. There is a small sugar
g 1,800 miles of coast in the central regions in that
t it has declined with the decline of price and now
y from Pernambuco and Maceio, points just south
rn point of the continent where the southeastern
make heavy rainfall on the moist low plain near

ne third South American sugar exporter. In that
sugar plantations are located in the fertile rainless
from which the high Andes cut off the moisture-
winds from the Atlantic. A few streams fed by the
ws and flowing down to the Pacific save this Peruvian
condition of hopeless barrenness. There is sufficient
igate parts of the valleys, and to make possible a
owth of cane, which along with alfalfa, orchards, and
tes a strong color contrast with the brown desert
last irrigation ditch. The yield per acre is good,
the proper amounts of sunshine, and water that
ords, but there is small room for the extension of
oduction.

tine Republic has an isolated cane-sugar region in
e province of Tucuman, latitude 28° south. The
per acre is rather low, but the total production is
the national supply.

he West Indies.—The history and description of

sugar growing in the West Indian Islands is in itself an economic and geographic study of some magnitude with many instructive phases. In the sixteenth and seventeenth centuries, these islands were much prized by the colony-owning powers of Europe, and they were the center of the world's sugar production. At the end of the eighteenth century they were in a high degree of prosperity, based on plantations owned by Europeans, worked by African slaves, and largely given over to the growth of export sugar and rum, distilled, then as now, from the cane juice.

The emancipation of the slaves brought decline in the sugar crop of many of the West Indian Islands, but in none so much as Hayti where political chaos succeeded French rule and the jungle is crowding more and more into the abandoned sugar fields. Latterly, the sugar growers of the West Indies, particularly the British West Indies, have had the severe competition of European beet sugar, which has further depressed the prosperity of the sugar colonies. Sugar is, however, an important export from Trinidad, Barbados, and Jamaica. Until 1880 it was practically the only export from Guadeloupe and Martinique, but since this date tobacco, fruit, and cacao have been claiming increased attention from planters. The discontent of British West Indian colonies, some of which desired to become possessions of the United States to get advantage of free import of their sugar into the United States, was one of the reasons leading up to the British action that produced the Brussels sugar conference of 1903.

The advantage of free admission of sugar into the United States is well shown in Porto Rico. After its annexation, a decade of free admission of sugar into the United States increased the crop of an island less than half as large as New Jersey, from 50,000 to 250,000 tons, and increased the value of the export from $2,500,000 to $19,000,000. This focusing of attention on sugar has caused the coffee export to decline from $7,500,000 to $4,500,000. The sugar is grown on the coast lowlands and the increase has come about largely through the consolidation of many small plantations and the modernizing of factories by American capital. The same process of capitalistic consolidation is in progress in the British West Indies, in some of which, as in Barbados, the industry has survived from colonial periods in a rather primitive condition.

on to its part in the sugar industry the island of
interesting as an example of the way man supports
m the earth. This island of 166 square miles has
people to the square mile. Two-thirds of the island
l and on half of it the tilled land is in sugar, which is
stand three years and is then followed by cotton,
atoes. Laborers at farm work earn thirty to forty
ay and the women half as much. "Field work is all
ıd. Sugar lands are cleared by hand labor and put
for the next crop with spade and fork. I saw very
er five plows during a forty-mile drive" (U. S. Con.
, 1911).

a strong contrast between this small-scale, semi-
ıstry of Barbados and the scientific and large scale
f Cuba and Hawaii.

uba is, next to India, the greatest cane-sugar producer
l, yielding at times one-fourth of the total produce,
all others in the amount exported. About half of
rated land in Cuba is in cane fields, which shows the
dence of the people upon this crop. In a recent
ccupied 78 per cent of cultivated lands in the Prov-
tanzas; in Santa Clara Province, 71 per cent; in
cipe and Santiago 35 per cent.; and in Havana,
and vegetables are important, 27 per cent; and in
, the tobacco province of the West, it was but 6
Normally the island has been producing during the
of the nineteenth and first decade of the twentieth
out 1,100,000 tons per year, but the war with Spain
vn in 1896 to less than one-fourth and destroyed
of the sugar mills. Under the stable government
d independence, it recovered its normal position by
s since taken a higher position than ever in the world's
t, the crop of 1910 being 1,900,000 tons.

gar plantations are usually of large extent, most of
ned by Europeans or Americans. The use of plan-
ads with locomotives to haul the cane to large
quite common. The plantations are being enlarged
ed machinery is being put in to reduce costs since
rising and the price of sugar declining. The present

price of two and one-fourth cents per pound at plantation leaves some profit.

Cuba has been able to produce such great quantities of sugar because she has had a fairly stable government, a population superior to that of most tropic countries, and an abundance of good, rich, well-drained sugar land. Only one-fourteenth of the sugar land is now in use, so that the industry can be very unscientific. When land has been exhausted the industry has been able to move, generally to the eastward from Havana where the industry had its first center. The increasing labor scarcity is at present setting the limit of Cuban sugar growing.

Hawaii.—The Hawaiian Islands, with a total area nearly as great as Massachusetts, are second only to Cuba as a source of sugar import for the American market. The sugar yield per acre is the largest in the world, due first to the virgin fertility of the phenomenal soil, decayed lava from the great Hawaiian volcanoes. Fine yields are further guaranteed and produced by irrigation on the leeward side of the islands. In the absence of suitable rivers at the right elevation for stream diversion the water is gathered near the sea level from streams and wells and pumped up, sometimes hundreds of feet, through iron pipes and spread over the fertile lava slopes, making some of the most spectacular plantations in the world. Hawaiian crops have averaged over 9,000 pounds of sugar to the acre, twice the harvest of West Indies or Java, and these islands in turn yield better than cane fields upon the rich delta of the Mississippi where the climate is too cool for the best growth of cane.[1]

Hawaii has had the especial advantage of receiving a higher price than any other sugar exporter except Porto Rico. This high price was due, before the islands were annexed in 1898, to the reciprocity treaty of 1876, admitting Hawaiian sugar to the United States without the payment of duty. The 11,000 tons produced in 1875 grew to 250,000 in 1899, and 506,000 in 1911. Since annexation all of the export goes to the United States free of duty.

This special privilege to the sugar growers of Hawaii has led to high profits and the suppression of other industries in the islands.

[1] Rains of December, 1911, were reported to have caused a loss of $8,-500,000 to the sugar-cane crop of Louisiana.

ts began when the islands had a few thrifty white many easy-going natives, giving an admirable oppor- he formation of great estates which loudly called for 'hese came from China until the Chinese exclusion them out in 1898. Then came Japanese until the overnment checked their emigration to the islands. laborers from the Philippines, Portugal, and Russia. ompaniment and cause of this population condition grown on a few vast estates. One company reported ving harvested 6,448 acres yielding 56,865 tons of 'erage yield of 8.76 tons of sugar per acre. It took ns of cane to make a ton of sugar (U. S. Con. Rep., 1). This cane is exceptionally rich, the yield phe- irge, as were the plantation profits of $2,261,000.

inced Development in Javanese Sugar Growing.— ind about the size of New York, is very remarkable l's commercial geography. Forty per cent of the vated. It supports a population of 30 million who od products for export. The chief export is cane ich it furnishes about one-fifth of the world's crop, d only to Cuba and India. In sparsely peopled e Cuba, sugar can often be grown on newly cleared the cane will live for many years with an annual sugar lands are often made to give six or eight or efore replanting. In Java, the larger area under makes it impossible to keep moving to new land, iost scientific agriculture to be found in any cane- on.

irst cutting of canes, following the plowing and plant- s the best, a field is allowed to yield but one crop, as n Louisiana because of frost. This is followed the beans, then by corn, then rice, then back to sugar. systematic cultivation and a complex system of control which at times amounts to compulsory igar output increased three-fold in the twenty years 384. When the Cuban supply was temporarily the devastation accompanying the War of 1895–98, an important part in supplying the United States, er in 1899 as much as 71 per cent of the crop. This

meant that every other day throughout the year, a tramp steamship skirted the coast of Java, loading 600 pound bamboo baskets of sugar for the American consumer, 10,000 miles away. After the United States, China is Java's best customer. The rest of the sugar goes to Japan, India, Australia, and other eastern countries, practically none of it going to the mother country, Holland, or any other part of Europe, because of the beet supply.

The Philippine Islands have admirable soil, temperature and rainfall for the growth of sugar. The sugar resources are much greater than those of Java, which is but a third as large; but the population is 8 million rather than 30, there is no Dutch Government with a system of compulsory labor, the industrious Chinese are excluded, and the high price of hemp and coprah have given other outlets for enterprise, and the United States has taxed the sugar when it reached the United States. The result is a fairly stationary sugar industry with smaller crops than were produced between 1880 and 1898. The methods of extraction and manufacture have always been wasteful, but improvement is expected as a result of a campaign of agricultural education now in progress in that archipelago.

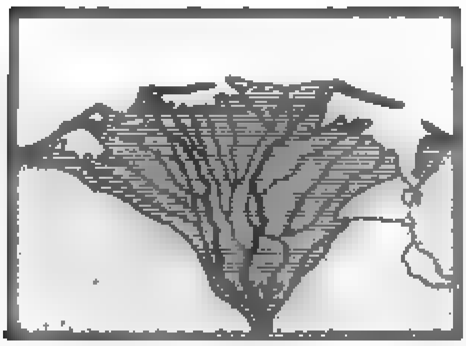


FIG. 95.—The Nile Delta surrounded by the desert shown in dots. One of the first oases in the world with a close counterpart in the Imperial Valley of California.

Mauritius, Reunion and Egypt.—Sugar is the predominating export from the two tropic islands of Mauritius (British, 713 square miles) and Reunion (French, 970 square miles) in the Indian Ocean near Madagascar. They have a combined population of over half a million, of whom a large part are industrious coolies brought from India and China, so that these small lands play a comparatively large rôle in sugar commerce, exporting nearly all of their quarter of a million ton crop.

Egypt has excellent resources of soil, sunshine and irrigation water to grow sugar, but she plays an unimportant role in this respect because her population of 930 per square mile demands rice, corn and beans, whereof the acreage far exceeds the sugar acreage.

ly and Production of Sugar in the United States.— States, with a sugar consumption of over 3 1/2 , has been growing cane sugar for a century, beet 1890, yet our import increases year after year, in fact that our home product has trebled within twenty

ar in the United States.—The home-grown cane-sugar had small chance of supplying the huge home demand

ng water by the rocker process in Egypt. One of the many ocesses by which the eastern peoples get water to their crops.

areas suitable for cane growing are limited, and ropic districts. The superiority of the tropics is in er than soil. The freezing of the American winter essary to plant the cane each year in Louisiana and nterferes with the crop. In the frost-free climates ords of fifty yearly cuttings from one planting, and orto Rico it has lived and been cut for twenty years, uban plantations regularly cut eight or ten crops nting. Those of Louisiana must plant annually four

tons to the acre, while the average yield is 12 to 15 tons per acre. There is the further handicap in the expensive labor of planting, occasional frost injury, and the fact that Cuban cane yields more heavily and has one-fourth to one-third more sugar in it per ton than that of Louisiana. These factors combine to make it plain that our cane-sugar industry is one which, like our beet sugar industry, could not survive without the high price produced by a protective tariff.

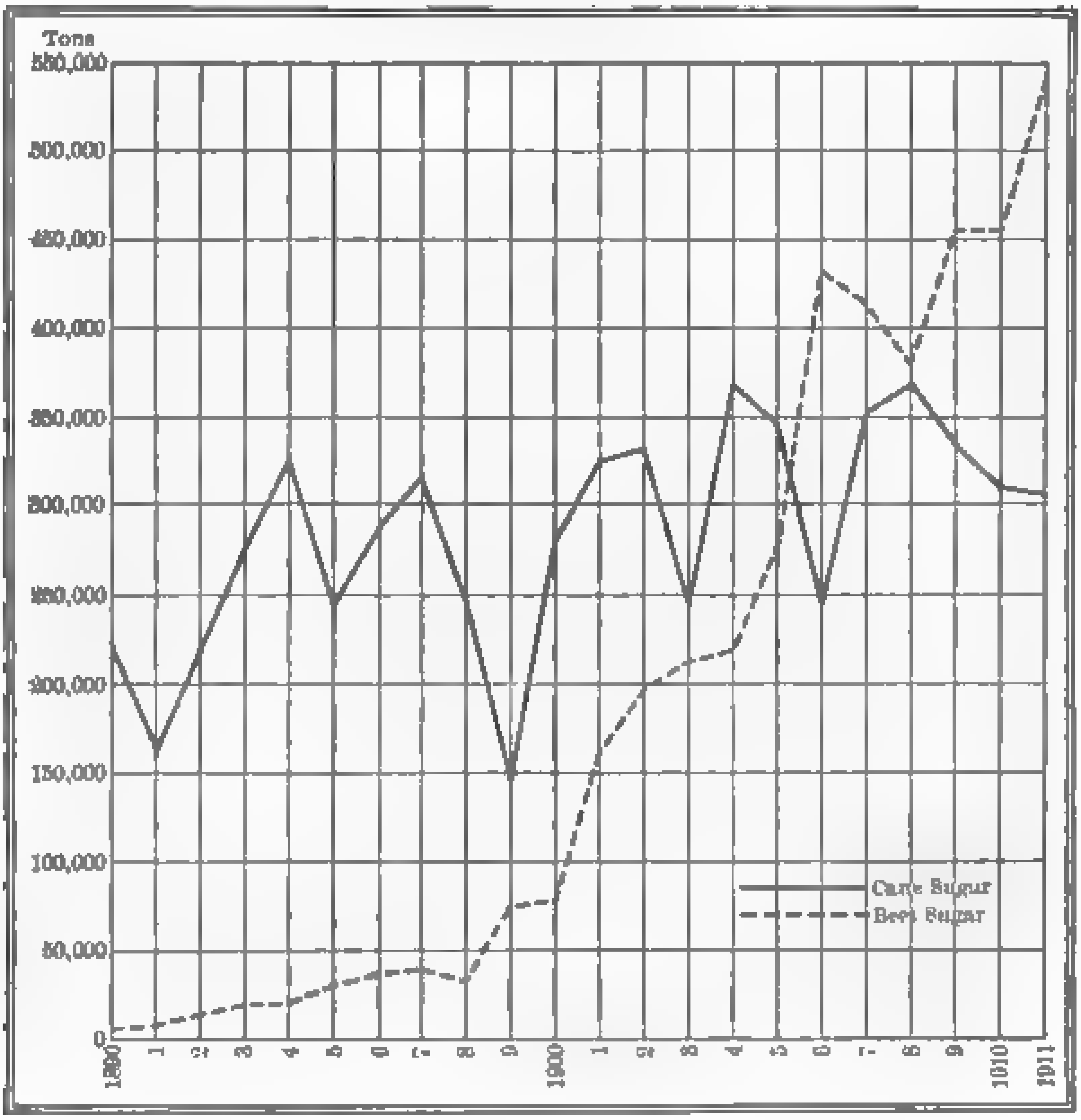


FIG. 97.—United States sugar production, 1890–1911.

Owing to these climatic limitations cane-sugar production, even with tariff aid, only attains importance in the southern third of Louisiana, a coast strip in eastern Texas and a few locations in Florida. The sugar territory of southern Louisiana is part of the

od plain of the Mississippi River. The only tillable in a mile or two of the Mississippi, or other streams, deposits of the overflowing streams have built up a few feet above the general swamp level. In two of (counties) of Louisiana (St. Mary's and Terribone), f the cultivated area was recently in sugar, while in r counties it was over 25 per cent and increasing. ane-sugar crop of the United States is not increasing nounts to about 4 pounds per capita for our people. ation is not set by land possibilities, for it is reported e 10 million acres of good cane land and now cultivate fifth of it. It should be kept in mind that this same drained, is good for rice, cotton, corn, and many forage meat production. The American cane-sugar growers s had to combat labor scarcity as well as troubles of l above all the uncertainties of the tariff.

ction of cane molasses for local use is a simple proc- ridely distributed in the south, and a little cane is this purpose as far north as Arkansas and eastern lina.

ar as a Local Supply Crop.—Beet sugar is only edible been through the machinery of a great refinery. In this cane juice is a prized article of food in all stages of e, and is often sucked directly from the cane itself, ure's stick of candy for the tropics, where it is widely t simple way. Living and yielding for years beside palm hut, the cane patch is a pleasing element in that s of support which the tropic climate yields to man e labor on his part. Crushed by ox or man power e rollers and boiled in the family kettle, it makes a ar supply than the grocery store yields in the land of

is an important and widely distributed source of food the thousands of Polynesian islands from Australia , and thence to Hawaii, 6,000 miles to the eastward. an industry where the human element is strong, as the Fiji Islands there is an important cane-sugar oducing under British management about one-fifth the cane-sugar crop of the United States. The

chief market for this sugar is in the neighboring islands of New Zealand. In the warmer part of Australia there is a very large area of admirable cane land, especially in Queensland, but the population is less than one per square mile, and the strenuous desire of the Australian commonwealth to remain a white man's

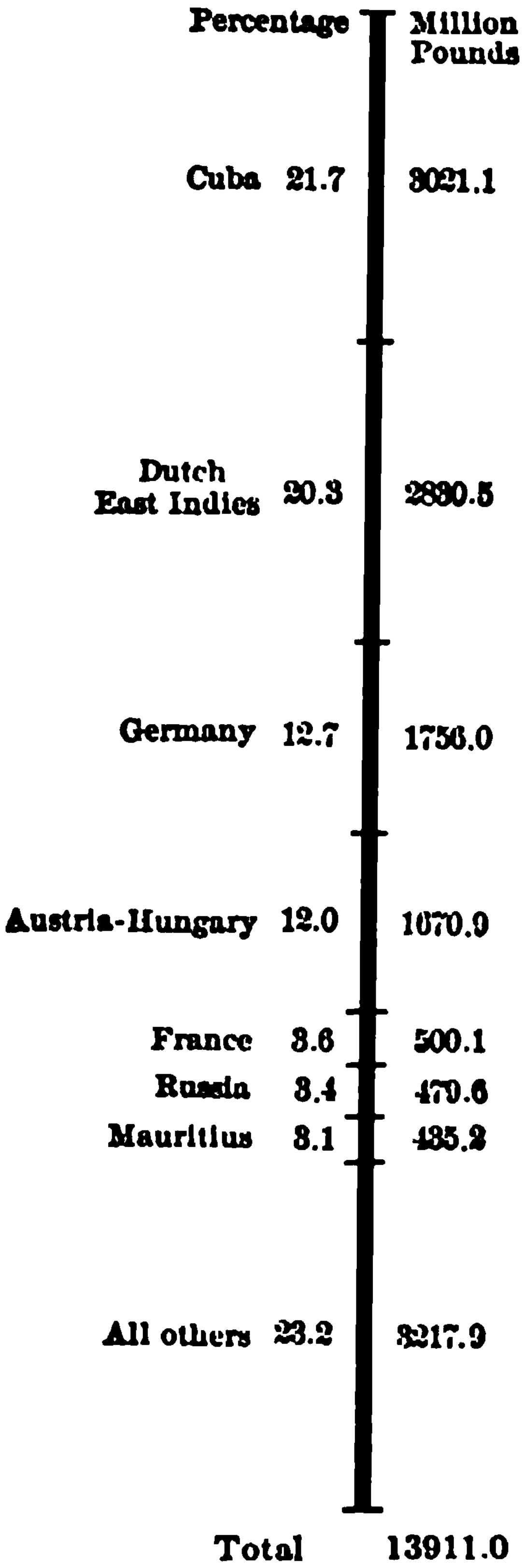


FIG. 98.—World's sugar export, three-year average, 1908–10.

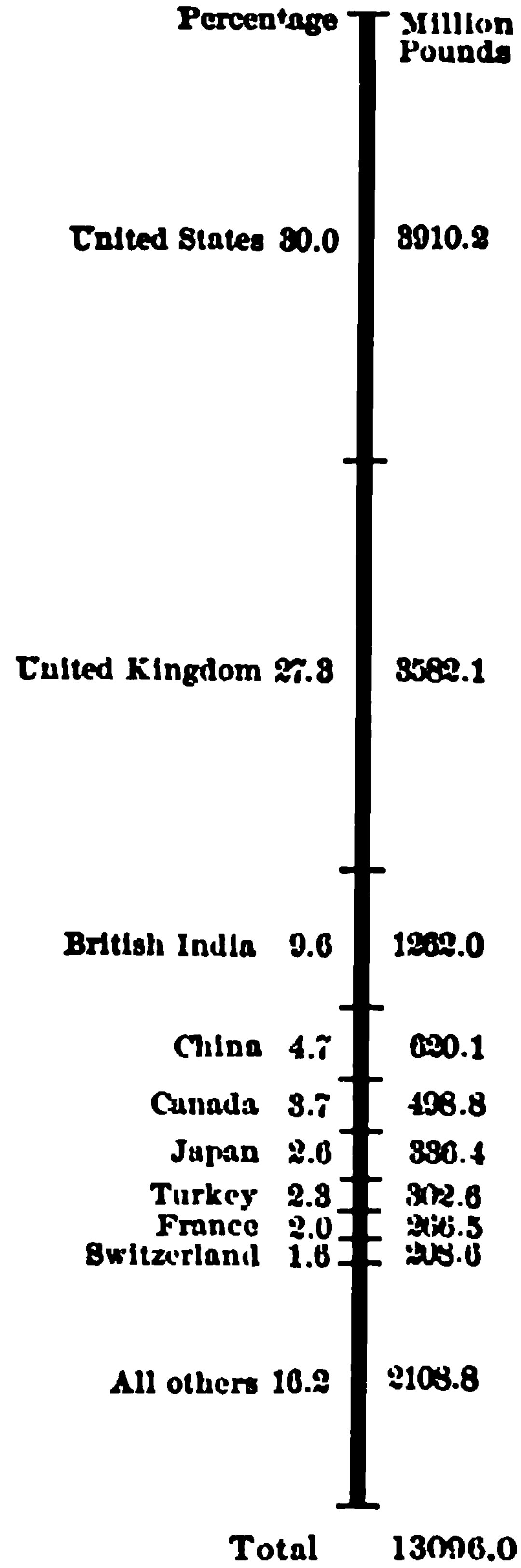


FIG. 99.—World's sugar import, three-year average, 1908–10.

land has caused the enactment of laws prohibiting the admission of the colored laborers (Hindoo, Chinese, or South Sea Islanders) who had been the planter's dependence. As white laborers will not go to the tropics, the Queensland sugar output is not increasing and that of New South Wales is small, and suffers from the same handicaps that interfere with cane growing in Louisiana.

ure of Cane-sugar Industry.—The growing of any nts of sugar outside the tropics has only succeeded rnments have shielded the industry from the compe- e tropic cane, and if the time should come when the temperate-zone population upon land resources need our sugar lands for other crops, an indefinite tropic land is ready to grow sugar for our supply. or of cane-sugar that science has not been so fully it as to beet-sugar growing. The latter started in ermany, the other has always been in far away d the cane has never been an important crop in the of any first-rate power. There appears to be much it possible in cane-sugar production in suitable

roducts of Sugar Making.—There is a great difference sugar mill that suffices for making the sugar and local use in the interior of Venezuela, Guatemala, ico and the modern mill for making export sugar. ill may have two or three small rollers turned by g 50 or at most 75 per cent of the juice. This is en vats, a primitive method which leaves much of the form of molasses, but the molasses is one of taples in the nourishment of the masses in tropic The others are corn cakes, beans, and cassava.) mmercial sugar plants, however, enormous rollers ure of many tons are driven by steam, 90 per cent is extracted, and a washing of the crushed cane gets l 5 per cent. The juice is evaporated in vacuum save more sugar and require much less skill, because ion takes place in the vacuum at so much lower that there is less danger of burning. The molasses rom this more scientific process has so little sugar s not fit for human food or even for the distillation ch has for centuries been the great by-product of antations of the West Indies. But rum, like good now a by-product only of a cast-off process used efficient plants of small plantations or backward .

ess molasses of the modern plant is fit only for the

distillation of industrial alcohol and the preparation of a cattle food which, under the name of molassquite, has of late become of increased importance. Molassquite is made by absorbing the sugar of the molasses in the spongy pulp that comes from the heart of the cane. When it is considered that but one-fourteenth of the possible sugar area of Cuba is in use and only one-thirtieth of the island under cultivation, we see here the possibility of an important trade with the live-stock producing countries of the temperate zone, for owing to the rising price of cattle foods, wheat bran and corn are now nearly as expensive as cane-sugar, which is as nutritious and as acceptable to the ruminants as to man. Ten pounds of mill (blackstrap) molasses are, with the addition of 2 pounds of cotton-seed meal, almost the exact equivalent as stock food for 10 pounds of corn.

There is no natural reason why we may not in the near future have a very important commerce in sugar and sugar by-products from the tropic countries, which will help to make cheaper meat, milk, and wool in the temperate-zone countries.

Crushed cane, from which the sap has been extracted, is called megasse, or bagasse, and is chiefly used for fuel in the boilers that run the engine of the sugar mill. A recent improvement permits it to pass directly from the crusher to the furnace, avoiding much labor in spreading it out to dry in the sun, as has been done for a century.

Maple Sugar.—Maple sugar is produced by the evaporation of the sweet sap of several varieties of maple which will grow over large areas of eastern and northern United States, where it was a very important factor in the days before world commerce in sugar. The process of manufacture fits the frontiersman. A small hole is bored about an inch into the trunk of the tree when the sap is flowing in the first days of spring. The sap flows out through a tube into buckets, is carried to camps in the woods, boiled in large open kettles or pans until the proper degree of thickness is reached, then poured into molds and crystallized into the delicious maple sugar. Some of the product is sold in a more dilute form as maple syrup. This kind of sugar costs more than either beet- or cane-sugar and would have no place in the world market at all but for its peculiar flavor and fine quality, which make it something of a luxury and enable it to command a

e. The sap only flows in quantities sufficient for satis-gar making where the days are bright and sunny ghts are cold. This climatic factor limits sugar or-the region from Indiana east and north. It is par-portant in the White Mountain region of Vermont and pshire and the adjacent parts of Canada.

r maple tree that yields from the time it is twenty or years old till it is seventy-five or a hundred certainly er sugar producers distanced for permanence, but the present low.

rom Sorghum.—Another sugar plant, sorghum, a the corn family and resembling both kaffir corn and , has long been grown in southern, central and south-ited States for the manufacture of syrup for local juice is extracted and treated in the same way that juice is extracted.

he Civil War when the blockade between North and ed shipments of sugar and especially molasses from o the North, sorghum was quite generally grown the corn-growing parts of the North, and in the form ed as a substitute for the product of the sugar cane. go this plant exceeded beets in the sugar content of it progress in improving it has been slow. Experi-d on for many years at Fort Scott, Kansas, have at l in the making of satisfactory sugar from it. Now s of plant breeding are better known, its sugar con-e susceptible of as great improvement as has taken beet. It is quite possible that a century hence it r even displace, beets in the United States, because can be cultivated with work animals and machines.

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CHAPTER VIII

CONDIMENTS AND TOBACCO

1. COFFEE

Distribution of Coffee.—Coffee is grown in many countries and has become a regular article of consumption in many parts of the world, but the estimated number of coffee planters in the world, 50,000, is less than the number of the corn growers of Illinois and the world's coffee crop, worth about $250,000,000, is not so valuable as the corn crop of that state. Several factors combine to restrict coffee-producing to limited but widely scattered areas. The plant cannot endure any frost and is therefore limited, with a few insignificant exceptions, to the region within the tropics, although the greatest coffee region, that of Brazil, is close to the edge of the temperate zone. The plant requires a hot climate, yet in many coffee regions the full blast of the sun is too hot for it, particularly for the young plants, and high shade trees are scattered over many plantations to cast some shade, while the young trees are grown with corn, bananas, beans or coarse varieties of peas to protect them from the full rays of the sun. The climate must be moist as well as hot, with a rainfall from 75 to 120 inches, yet the soil must be rich and also well drained, which practically limits coffee growing to hills and highlands where the streams have rapid fall to give the necessary drainage. These conditions, therefore, tend to locate the best coffee-producing districts upon plateaus and hilly regions. As the coffee is usually grown for export, it must, in addition, be reasonably near the seacoast, and a considerable population is necessary to perform the large amount of labor required in caring for the crop.

History of the Industry.—Coffee, unlike wheat, corn, rice, and beans, is not a staple handed down from distant ages. The plant is probably a native of Abyssinia, whence it was taken to Arabia about the eleventh century. Its spread was slow and

in 1562 that the first coffee houses were opened in As an important article of commerce, coffee really the nineteenth century, the quantity consumed ctically doubled between 1855 and 1885 and again time and its use is rapidly increasing. The source mmercial supply has shifted much. At first, it was t of Arabia, then the West Indies, then Java had the and lastly Brazil has taken the lead with a production ng all competitors.

wth and Preparation of Coffee.—The tree naturally om 25 to 30 feet in height, but in the coffee orchard ntly pruned and kept down to from 5 to 8 feet in ermit easy picking of the berries. The berry, which like a cherry, usually encloses two coffee grains in After picking, the berry is put through a number of processes the first of which takes off the outer pulp. the berry is dried in the sun, a process requiring eight days. Other machines then remove the two ıer husk, and various sortings and gradings separate that those comprising each kind of coffee are of the rance and size. Rather complicated machinery has ed to do most of the coffee curing after it has once by hand.

Coffee Growing.—One of the best places for the offee is found on the slopes which face the lower the Red Sea in Yemen, the southern part of the insula, and the home of Mocha coffee. Here the coffee tree has the advantage of a mist which lower plain almost every morning in the year and envelops the coffee-planted slopes in a haze which full rays of the sun and also gives the proper moisture development of the plant and the production of its

uality of this Arabian coffee is due chiefly to the s carefully prepared, most of the crop being bought by Turkish and Egyptian merchants who personally the harvest. The amount of coffee grown in Yemen ller than that which is sold under that name, and naller than the demand. In Yemen coffee is purely

a money crop, and is not used by the natives, who drink a decoction of the dried hulls. Only a small proportion of the Yemen land suitable for coffee is planted to that crop. Most of it is in dhurra, a grain resembling millet, which will give sixteen crops before the coffee trees are ready to bear. It is a long-time proposition for an Arab to wait for the coffee tree, especially as Yemen is rather an arid country with inadequate irrigation, poor roads, high taxes, and the bad government that has so long blighted the Turkish Empire.

India and Ceylon and Dutch East Indies.—The British Government, which has done so much to encourage agriculture in its colonies, encouraged the establishment of the coffee industry in India and Ceylon. The chief Indian district is located on the eastern or interior slopes of the western Ghats Mountains in southern India, where elevation and climate suit it. The acreage in southern India is declining slightly because of low price of coffee for twelve years following 1897. In Ceylon, with its moist highlands, coffee growing quickly assumed an important place, and by 1880 was the chief export of the island, $15,000,000 worth being sold abroad annually. But a fungus disease producing leaf rust broke out in Ceylonese coffee plantations, so injuring the trees that they could not produce much fruit, or killing them outright, bringing ruin to many coffee planters. Some sought substitutes in growing cinchona, but most turned to tea, which has almost replaced coffee as a crop upon the Ceylonese highlands. The only way to circumvent the blight which killed coffee of the Arabian species was to introduce the more hardy Liberian coffee, a native of west Africa, and even that is not entirely immune to the blight. This species of coffee is now grown in Java, a name under which not only the product of this island is sold, but also the small amount of coffee produced in Sumatra, Borneo, and Celebes and some from other places. The Java coffee has a good quality because it is grown at an elevation of from two to four thousand feet upon government plantations, where careful measures in harvesting the crop are rigidly enforced. The total coffee crop of Asia and the East Indies in 1910 (84 million pounds) was less than one-sixteenth that of Brazil.

Coffee in Tropic America.—Coffee is one of the best money crops for the tropic highland, and for this reason is well suited to

Central America, and western South America. In all ons the ruggedness of the country makes transportation the roads are exceedingly bad, and the trail for pack often the only means of access. Only valuable prod- pay for such transportation, and coffee, worth from six cents a pound, stands in a class alone when compared at worth possibly one and one-half cents a pound, or ith its low value and difficult form, or coal, sold at 4 or for a cent. Geographic and economic factors combine resting way to influence coffee production in mountain The elevation that produces the best coffee conditions re, temperature and slope also makes a more endurable at has attracted the bulk of the population of nearly American countries. Into this natural labor situation, well with its actual and relative ease of transporta- ie high prices prevailing in 1887–1896 made coffee ery prosperous, and it became one of the chief money Mexico, Central America, Columbia, Venezuela, and

and Central America.—In Mexico coffee does best in one of the three topographic zones which comprise l country. The first division, the hot low plains along ast, are considered too hot for coffee; the second, the au enclosed between the eastern and western cordel- dry and too cool, but the outer slopes of the plateau, d warm land of the Mexicans, with its good rainfall cession of fertile, warm valleys and forest-clad slopes, l coffee zone. Some of the plantations extend south Isthmus of Tehuantepec, which, however, is not high best coffee growing.

rd the elevation increases and the plateau of Guate- Salvador is an almost continuous coffee plantation oundary of Mexico to the boundary of Honduras. mall states produce more coffee than all Asia and the , and it comprises over two-thirds of their total export. e Guatemalan plantations are owned by German cap- the Germans import much Guatemalan coffee. At e the coffee crop employs half of the population. In the plateaus are even higher and the coffee tree upon

the hillside is the chief means by which the people of this cool plateau secure the European and American imports that are brought to them by the little railway that climbs up 5,000 feet from the Caribbean port of Limon to San Jose, the Capital.

Venezuela, Colombia and the Andean Highlands.—Colombia and Venezuela, being in the hottest part of the torrid zone, have such high temperatures upon their lowlands that few persons live upon them except the few necessary to carry on the commerce between the seaports and the interior plateaus among the northern ranges of the Andes. Here again the valuable bag of coffee, upon the back of the mule as he climbs down to the seaport or the river steamboat landing, represents the best money crop that could be produced in these isolated plateau districts. Small quantities of coffee are also produced on the plateaus of Ecuador and on the eastern slopes of Peru, whence it must be carried by mule and railway over the forbidding mountain chain of the Andes. These Andean countries produce about as much as Central America, but not one-tenth as much as Brazil. On the eastern slopes of the Bolivian Andes is the Province of Yungas, which claims to have the best coffee in the world, but there is not enough of it for export.

The West Indies.—The coffee tree will grow in nearly all of the West Indian Islands, but the island of Hayti, occupied by the two states of Hayti and San Domingo, is the heaviest exporter of coffee, shipping from 2 to 3 million dollars' worth a year. In Jamaica the "Blue Mountain coffee," the highest priced coffee in the world, is produced. Its fine quality is due to the alternating rain and sunshine that here lasts throughout the year, but the crop only amounts to four or five thousand tons per year, and it is ceasing to be a plantation crop, and is passing into the hands of the small cultivator. Porto Rico is well fitted by climate, soil and labor supply to produce the good coffee that has for many years been an important export. Before this island was annexed to the United States, the chief market was in Spain, where the Porto Rican coffee with its peculiar flavor was in demand. When the Americans took possession, the Spanish imposed a tariff upon Porto Rican coffee, depressing its price, and producing hard times in Porto Rico, but the United States government has tried to improve the methods of coffee growing and

rieties that would be acceptable in the markets tates.

l is lord of the coffee world, overshadowing all combined, exporting in 1910 four-sevenths of the pounds entering com- fourths of the world's ed there, yet the coffee but a small corner of which is as large as the and Great Britain com- s of railways thread the d come down to the two rts of Rio de Janeiro and

d prosperous city of San pital of the Province of he chief city of the coffee- trict, which slopes away Range, toward the Parana nterior. On this plateau, nd 2,500 feet above the nds of square miles of a pable of producing several coffee as the world needs. trade winds bring from ntic an abundant rainfall, e natural conditions for on.

se of this abundance of ian coffee estates are often ize. In times of prosper- rs live luxuriously in the rope, while the estates are

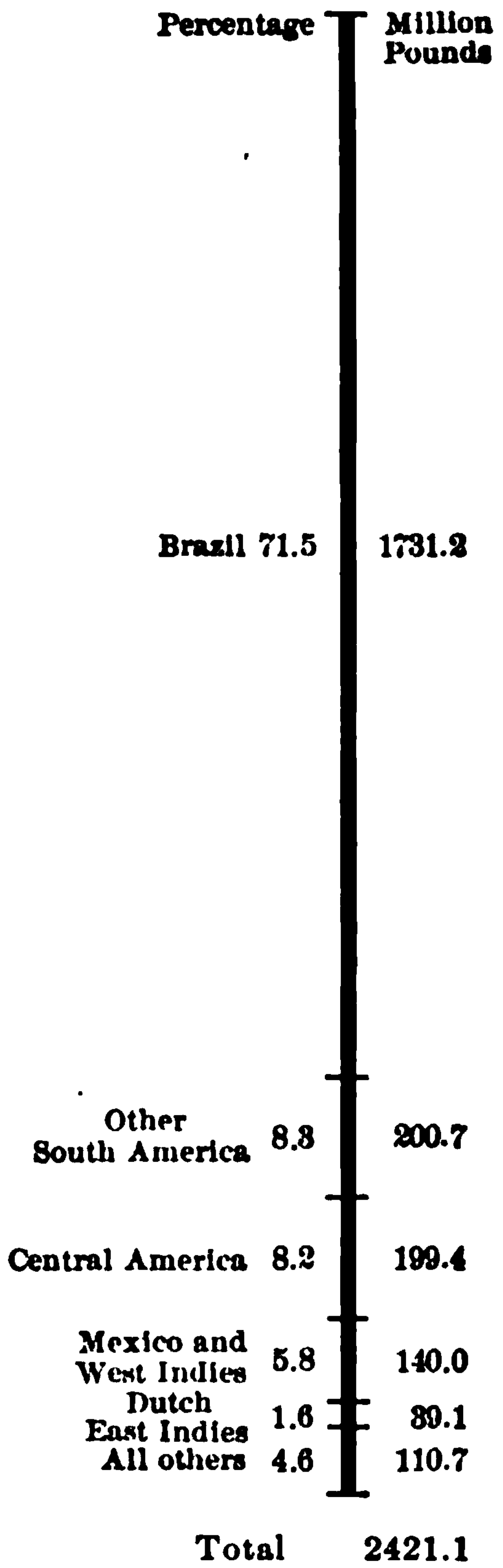


FIG. 100.—World's coffee production, three-year average, 1908–10.

overseers who employ as laborers the incompe- ho were slaves until 1892. Of late Italian immi- gun to replace the negroes, who are drifting to the nts north of Rio Janeiro. Brazilian coffee does od a name in the world's market as does that of , chiefly because of the inferior care bestowed upon

the harvesting in a country where efficient labor is so much r difficult to obtain than it is in Java and Yemen. In Java, ripe coffee berries are picked off, while the green ones are allo to remain upon the branch, but in Brazil it is not uncommo green and ripe berries alike to be swept off the branch by a si motion of the hand, with the result that the unripe coffee m

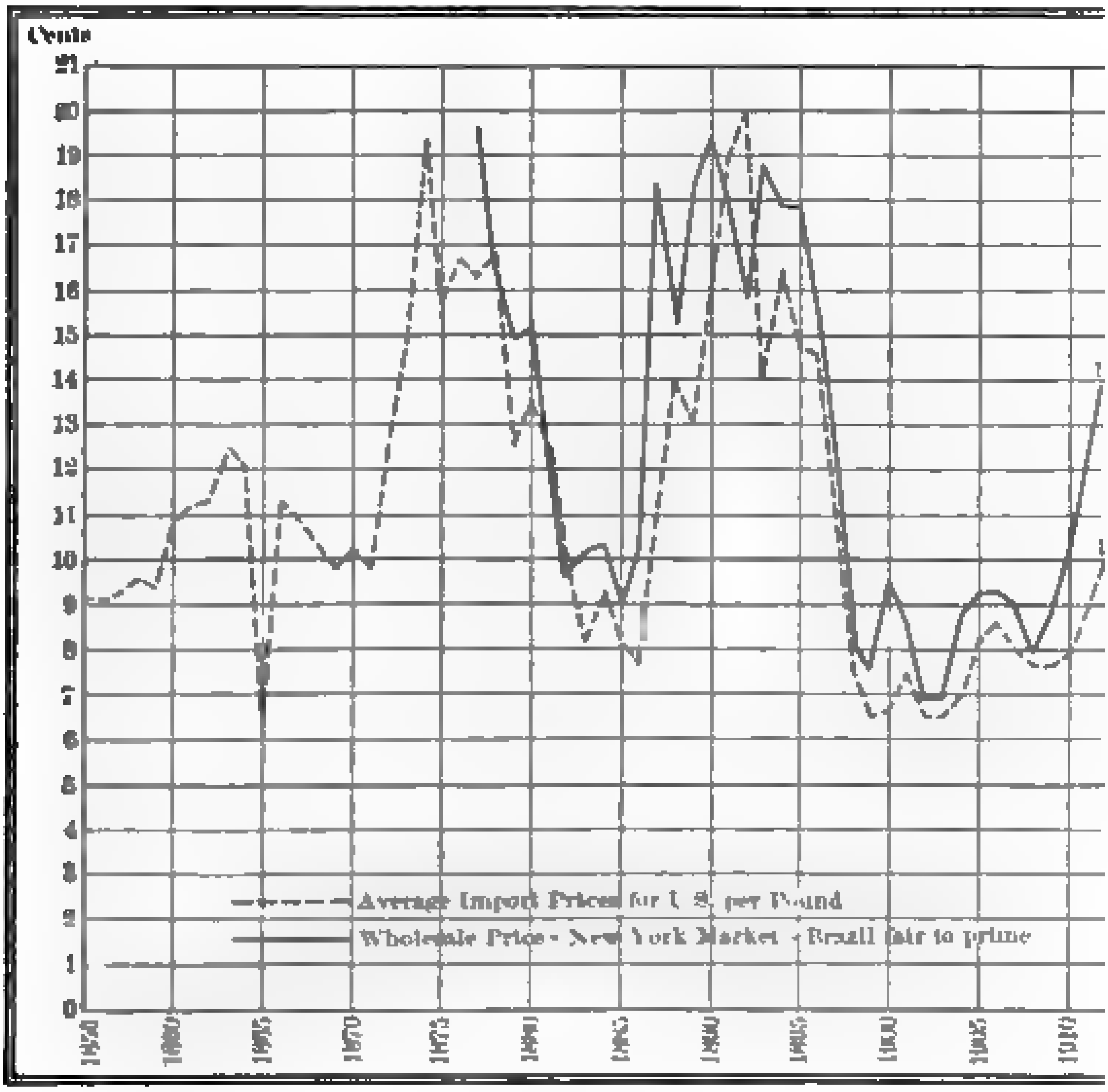


FIG. 101.—Cycles in price of coffee—a product capable of easy overprodu (Idea from Chisholm.)

a product of inferior character. Great efforts have been ma Brazil of late years to improve the quality of coffee, espec through the introduction of improved machinery. As machinery is very expensive, large coffee-cleaning and gra establishments are to be found only in the large towns, an a few of the largest plantations. Some of the plantations ar large that private railways run through them to carry the w

offee from one place to another. As the land is cheap, ıltivation prevails, and the heavy rains do enormous the resources of the country by the washing away of soil.

luctuations in Price.—High prices prevailed in the ket from 1887 to 1896, and enormous numbers of coffee planted in nearly all coffee-growing countries. The to bear in about six years and may yield for thirty or . By 1897 the production was so large that the price he yield kept on increasing until 1902. The chart of s shows most conclusively how this industry had been by the heavy planting of trees in time of high price sence of planting which comes in periods of low price, ernate booms and depressions.[1] The hard times fol- fall of prices in 1897 made great hardship in Brazil, as ther regions where coffee was the chief export. 'ort to restore prices, which were practically down to production, the Brazilian government taxed new coffee for several years and financed a great attempt to buy ›lus of coffee and hold it for an advance in price.

'ee Supply and the Decline of the Industry in New lons.—The fall of coffee prices from the profitable 95 to the unprofitable level that prevailed for more ade after 1897, being a world phenomenon, suddenly spread of coffee growing in other countries where it cently introduced. In British Central Africa, coffee on the Shire highlands had just been established, other exports in value, but the low prices, aided by educed the area under cultivation in less than ten 17,000 acres to 5,000, and the planters sought a more ubstitute for the coffee upon which they had based hopes. A similar fate has overtaken the coffee in- awaii and Paraguay, in both of which countries, as in t Africa, the industry was just springing up, but could e with Brazil, which is more than able to furnish the re miles now needed to grow the world's coffee.

ency of industry can be seen in many industrial activities, in that large class of agricultural products subject to over-

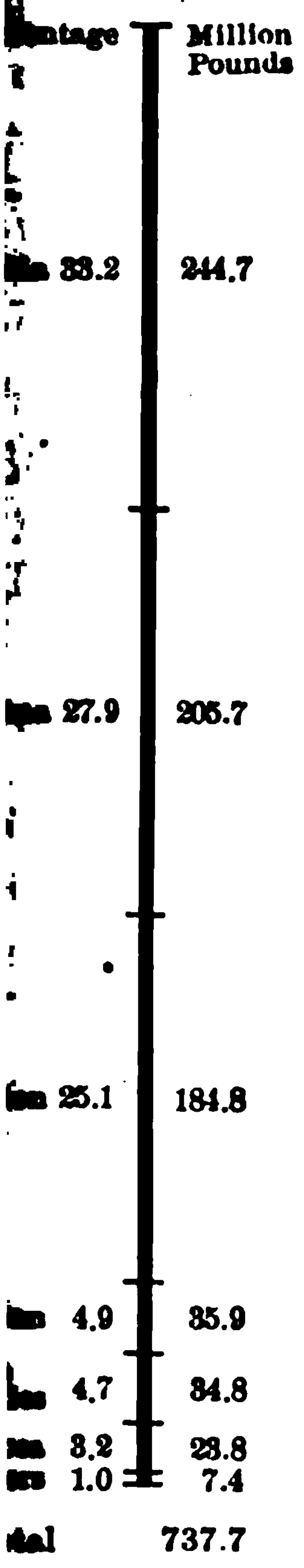
Although coffee was early introduced into England, its use there has been largely replaced by tea. The Dutch, owners of coffee-growing Java, are the leading coffee users, with a consumption of 20 pounds per capita per year. The Americans and Belgians use half as much as the Dutch, and the Germans and Swiss one-third as much. Coffee is the chief non-alcoholic beverage of France and other countries of west Europe, and Havre has become the greatest coffee market, millions of sacks sometimes being in her warehouses.

2. TEA

Factors Affecting the Distribution of Tea Culture.—The usual tea of commerce is the dried leaf of a tree native in the hills of Assam, one of the eastern states of British India. In cultivation the tea tree is usually kept down by pruning to a height of from 5 to 6 feet so that the leaves can be picked by hand, but when allowed free growth the tree attains considerable size. Little oil cells give the leaf its flavor, while the stimulating quality comes from a substance called theine which is almost exactly the same as the caffeine of the coffee and the stimulating principle in cocoa or chocolate. The tree is quite hardy, standing a frosty climate, thriving in central China and the cotton belt of the United States, and many places where no tea is produced. The distribution of the tea-growing industry gives us one of the best examples of the combined working of geographic and economic forces. The large amount of skillful hand labor required in packing and preparing tea makes it necessary that tea be grown in regions of dense population with its resultant low wage. The plucking of the leaves, especially the young leaves, is one of the hardest things a plant has to stand, hence the tea only produces adequately where an abundant moisture supply and a warm summer promote growth.

Consumption of Tea.—The cultivation of tea began at a rather late date in Chinese history, about the ninth century A. D., and it was long the only Chinese export to the western world. Some of the leaf was introduced into England in 1657, and commanded in that country a price of $15 per pound in 1665, but at the end of that century, it was quite common and Britain

rt became the leading tea-drinking nation. The f the tea habit seems to show a clearly marked ational commerce. Britain began with tea at the t she triumphed over her great sea rival, Holland, ping has given her a large part of the world's tea



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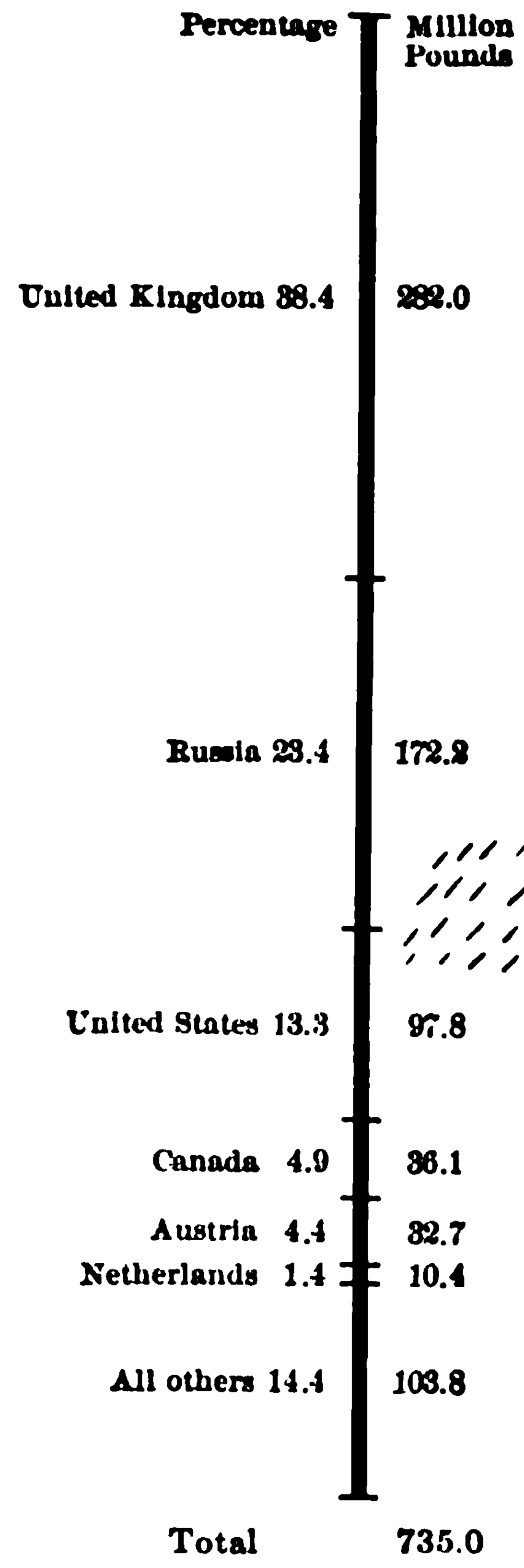

FIG. 103.—World's tea import, three-year average, 1908–10.

ll as its tea consumption. The English-speaking ume nearly three-fourths of the commercial tea and her long-used caravan routes to China uses nearly

The consumption per capita shows it to be essen-ink of Orientals and of the English peoples, the

average per person being 6 pounds per year in the United Kingdom, 7 pounds among the Australasians who are thoroughly British and more able to buy than those of the United Kingdom itself. Canada averages 4 pounds per capita, Holland 1.75, the United States 1.4, and Russia 1.25. The Russians are generally described as being great tea drinkers, and this is true for the wealthier classes, but the vast masses of the Russian population are too poor to buy it. The Germans consume less than one-seventh of a pound per capita, and the French (wine growers and coffee drinkers) but an ounce per year. Its use is very common throughout Siberia, the Trans-Caspian Provinces, and Persia, as it has for some centuries been a commodity in the caravan trade across the heart of Asia.

Chinese Tea Industry.—It is impossible to say how much tea is used in China. It is widely grown in that country in family gardens for home use,[1] and although it is all grown in the tea gardens of the small land holders, chiefly in central China, that country was for a long time the leading country in supplying it for export.

Chinese tea is usually picked three times a year, the first growth in March, the second in May, and the third in August. The choicest first pickings are so highly prized at home that they are practically never exported; the later pickings of an inferior grade are for the use of foreigners. After the picking, which is usually done by women and children, the leaves are wilted in pans over a fire. They are next rolled into balls by hand to squeeze out the sap, and dried upon screens, care being taken not to let the hot sun burn them. After this, they are further dried by "firing" in copper pans over a fire, being stirred the while, it is said, with bare hands, although the pans are white hot. Inferior teas are stirred with sticks. After this, the leaves are hung up in sacks for a day, then picked over, sifted, assorted, and packed by aid of bare feet into tea chests for export. In some grades of tea, each leaf is rolled by human fingers. The difference between black and green tea is merely a question of curing, although the two kinds are rarely grown in the same

[1] The tea habit of the Chinese and Japanese seems to be an attempt to make pleasant the habit of drinking boiled water—a necessity recognized long ago by these peoples living on a land laden with germs resulting from the density of population and habits of fertilization.

If the tea is to be black, rather than green, it is, early
ng process, piled up in heaps half cured and allowed to
which drives off half of the tannin, of which tea has
ent. This changes the flavor and gives a quality that
sired in many markets.

Province of Szechuen, one of the western provinces
lwaters of the Yang Tse Kiang, is a very large popula-
iated at over 16 million, a number about equal to
ation of Brazil. They have supported themselves
and location for generations by household industries
ulture, most of their few exports going down the
the Yang Tse Kiang to Hankow and Shanghai, but
send into Tibet some of the worst tea in the
is made by cutting off 12-inch twigs of a tea tree,
ying them in the sun, chopping them up, twigs and
g all together with rice paste and then compressing
nto hard bricks for shipment over the fearful passes
upon the backs of coolies, mules and camels. The
e of carrying this compressed form of tea accounts
ment by caravan into Russia at an early date. The
of brick tea shipment is Hankow on the Yang Tse
entral China, and while the tea has generally been
of very poor quality there has been great improve-
ate years, and some of the brick tea is now made
hinese city under Russian management, and great
rcised to see that the quality is good.

Tea requires fertile but well-drained soil along with
sture, a combination of conditions usually furnished
hillsides. This fact, in combination with the large
labor required, makes it a crop admirably suited for
ere the vast demands for food cause the level land to
for rice and grain crops, and makes tea growing in
on the steep hillsides fit in admirably with the Japanese
For home use they still prepare it by hand in the old-
way, but for export it is almost entirely cured by ma-
e standard Japanese teas being green teas and the
tes their principal market. Thousands of boxes are
ly to Chicago, St. Louis and other interior points by
Trans-Pacific steamers which sail from Yokohama to

Vancouver, Seattle, Portland, and San Francisco, at which points they connect with the Trans-Continental American Railway lines.

Formosa.—The best tea in the world is grown by Chinese people in the island of Formosa, which has belonged to Japan since the Chino-Japanese War of 1894. The eastern half of this tropic island is still possessed by head-hunting savages, and tea growing by the Chinese emigrants of the west half is a comparatively recent industry. Most of the 18 or 20 million pounds per year is cured by American and English firms for sale in their home countries.

Introduction of Tea in British Colonies.—The world's tea trade has been revolutionized during the last fifty years as a result of activities of the British government in introducing tea growing into India and Ceylon. In the year 1888 the British import of this commodity from China fell below that from the British Colonies of India and Ceylon. Between 1881 and 1900 the Chinese export fell from 300 million to 215 million pounds, and in the year 1905 we had the remarkable spectacle of a commission of Chinese experts sent out from the tea-growing Province of Nanking to study condition of tea growing in British India. China had fallen so far behind because her unprogressive tea growers clung to the old hand methods of their remote ancestors, while the rivals under the British flag and the British teacher had attacked the problem in the scientific spirit and with unbiassed minds and had been using many labor-saving machines. Another result of this growth of tea in new regions has been a steadily decreasing price since 1885, so that at the present time tea growing is not a very prosperous industry.

About a half million acres are grown in India, four-fifths of it being in the northeastern part in east Bengal and Assam, regions tributary to the port of Calcutta. It is grown upon the hills sloping down from the great plateau of Tibet and is grown to some extent in many other places along the southern slopes of the Himalaya Mountains, a district receiving tremendous summer rains. In southern India on the Nilgiri hills is the most important tea district outside of Assam and Bengal. Owing to its low latitude this district produces best at an elevation of from 4,800 to 5,600 feet above sea level, while upon the slopes

ɪalayas the plantations find the temperature that best
t 3,500 feet or less.

n Tea Industry of Ceylon.—In contrast to the three
ngs of the temperate zone, the tea of India is gathered
lays during the period of the monsoon rains in summer,
ds of Assam like those of Japan average 450 to 500
tea per acre. On the still more humid hills of Ceylon
bably the best tea-growing region of the world. There
lucked every two weeks throughout the year and has
00 pounds of dry tea per acre, a quantity 20 per cent
actual weight than the average wheat yield of the
tes.

ving is a new industry in Ceylon, having been taken
ddenly by the coffee planters after the blights had
the coffee trees. In 1867 there were 10 acres of tea,
'00; in 1897, 170,000; in 1904 there were 338,000, but
vere so low that no new tea orchards were then being
The export of tea from this island reached a million
1883, 148 million pounds in 1900, and 182 million in
Ceylonese method of tea growing is typical of the
sful method of prosecuting tropical industries. More
the plantations are owned by corporations, and prac-
are managed by English superintendents. By this
average size of the plantation is raised to 300 acres,
ina it is probably a small fraction of an acre. The
plantation work is done by coolies, men, women and
any of them being Tamils from southern India, and
y return to their homes across the straits after a
ork gives them a little money. The intensity of the
and its dependence upon a dense population is shown
that less than 600 square miles of tea plantations
ut 400,000 coolies. This is one person to the acre,
rast to the American corn belt farm of 160 acres, on
proprietor often has but one hired man to help him
arvest 40 acres of corn, 40 acres of hay, 40 acres
d fatten 40 cattle and grow 60 hogs, besides rais-
horses for his own use with an occasional pair to sell.

r Factor and United States Tea Growing.—The vast
hand labor in pruning and caring for tea trees and

picking and curing the tea shows why the tea industry has not been developed in the United States, although it has long been known that the tea tree thrives well over an area 100 times greater than all the tea plantations in India and Ceylon. A little tea of good quality has for some years been produced near Charleston, chiefly by the labor of negro children, but naturally the industry does not expand in this region of relatively high wages. It costs fifteen cents a pound to pick tea in South Carolina and the laborers there have been unable to learn a certain dexterous move that pulls a leaf without destroying the bud in the axis of its stem. To avoid this they pinch it off leaving about one-third of the weight of the leaf.

Tea Districts of Minor Importance.—Tea growing has been carried on to a small extent in a number of places throughout a rather large part of the world in which the tree would naturally thrive. Among them may be mentioned Johore in the Straits Settlements upon the Malay Peninsula, French Tonquin, Southern Burmah, Jamaica, the Fiji Islands, Madagascar, Brazil, the Russian province of Trans-Caucasia. In none of these regions has it been an important success, chiefly for labor reasons, but in Trans-Caucasia it seems doomed to failure because the resemblance of the climate to the Mediterranean type with its dry summer, will not permit sufficient growth of the leaves.

Java has the best combination of conditions to rival the four great tea-growing countries of China, Japan, India and Ceylon, but the low prices have caused a decline of tea acreage even there. The coffee planters of Natal with their fertile slopes facing the Indian Ocean moistened by the southeastern trade winds, turned, like those of Ceylon, to tea when the blights of the Seventies desolated their coffee plantations. In 1905, they had about 4,000 acres of tea growing at an elevation of about 4,000 feet along the Tugela River and were supplying about 2 million of the 6 million pounds of tea used in Africa. In this district the conditions of management are quite like those of Ceylon, the managers being British with coolie laborers imported from India. The most that Natal can hope for is to supply the South African market.

Other Teas.—The leaves of a number of other plants are locally used as tea in various places throughout the world. In

rn United States the Cherokees and other Indians leaves of a holly plant from which they made yupon, drink." In Australia the eucalyptus leaf is used. ica has a so-called Bushman tea, a grass called lemon ed in India, while in the Island of Bourbon or Reunion ian Ocean, the so-called "bourbon tea" is made from id.

ie minor teas the maté or Paraguay tea is the nearest rival of the ordinary tea of commerce. This plant, member of the holly family, grows wild in southern in Paraguay, in which latter country it is also grown ons. The leaf is dried, but less carefully than the tea nt. It is widely used by the people of Paraguay, and llion pounds are exported to Argentine Republic, and Brazil, together with smaller quantities to some of South America. A little is even sent to Europe mount is rapidly increasing, the total export from passed a half million dollars in 1909, and some is now rted from Brazil. The summer rains of the matè belt apid leaf growth necessary for a leaf-yielding crop like

3. CACAO

ifusion of Names.—The chocolate and cocoa of com- prepared from the seeds of the cacao tree which, be- s name, often gets confused with the coco palm which e large, hard-shelled coconut (often spelled cocoanut). confused with the coca tree, the leaves of which are rket from the east slopes of the Andes in Peru and way of the Amazon River or the Pacific ports for the n of the drug, cocaine. The word cacao here refers to ean.

ind Introduction.—The cacao tree is a native of merica, growing wild in the Amazon and Orinoco ey forests up to an elevation of 400 feet. At the time overy of America, it was grown from Panama to Guate- Yucatan, and to some extent in the lowlands of Mexico, ountry it was so prized that the dry seeds passed as

The low plain upon the western coast of that country by the equator, where the doldrum rains and ever-

e heavy fruits of the cacao tree cannot mature in windy location. (Photo Walter Baker & Co.)

s make it a striking contrast to the trade wind deserts ame coastal plain in the adjacent country of Peru.

Cacao is the chief money crop of the Pacific Plain of Ecuador. The trees here find every condition suited to them and the jungle easily becomes the cacao orchard. As with the banana, plowing is not necessary, the only care being enough chopping to prevent the smothering of the young trees.

Ecuador and Brazil Compared.—In the year 1900 it was estimated that 600 square miles of land yielded all the 67,000 tons of cacao grown in the world, yet Ecuador alone boasts of having several thousand square miles of good cacao land. But this in turn is as nothing in comparison to the hundreds of thousands of square miles of equally good cacao land in the Amazon valley of Brazil and neighboring countries. But cacao growing is not a comfortable business and it takes large profits to tempt men to do it. The Ecuadorean growers all desire to live elsewhere. The climate of the cacao forest is unwholesome to the white man, the jungles swarm with dangerous animals, poisonous serpents and pestiferous insects. Fevers are common, and labor naturally is scarce. Although sparsely settled, the low plain of Ecuador is populous in comparison to the empty jungles of the Amazon Valley of which Ecuador, Peru, Colombia, and Bolivia each own an area greater than the Pacific Plain of Ecuador. However, the scattered settlements along the Amazon have recently produced as much cacao as Ecuador. In the Amazon Valley the cacao export is second to the great forest product of rubber. In Ecuador it is first not only for the low plain but even for the whole country which is composed of two widely differing districts—the steamy low cacao-growing plain and the Andean plateau nearly two miles above it, so cool that the temperate zone crops of corn, beans, and wheat are the chief crops and food of the people and hides are the chief export.

Trinidad and the West Indies.—The British colony of Trinidad lying below the hurricane belt and with many protected hollows is the third American cacao-exporting country, while Venezuela and San Domingo are close rivals for fourth place.

A little cacao is grown in many West Indian Islands and throughout Central America, but it is chiefly for local use, although Guatemala and the adjacent parts of Mexico claim to produce the best cacao in the world.

Old World Cacao Growing.—Cacao, being a native of America

recently of importance in commerce, has not been grown the Old World but the greater labor supply of the Old opics bids fair to make those regions outstrip America port of the precious beans. The tropic islands of Sao (or St. Thomas) and Principe (or Prince's Island) lie e equator in the Gulf of Guinea, and while they have 45,000 people (of whom 96 per cent are negroes), and rea of but 360 square miles, they have the cacao climate tile volcanic soil. In the year 1905, this tiny Portugese outstripped Ecuador and all other cacao-producing . This is not a measure of superiority of resources. ause slavery still exists there and the task master can native work.

cent introduction of cacao growing into Ceylon has led id increase there, and it may possibly repeat the experi- he tea industry which succeeded coffee, and has itself nprofitable after making the island take first place among ters. In Java also the climate and the labor supply le and cacao cultivation has been established in a small has also in the island of Reunion. Its growth has been Samoa and other Pacific Isles, but the population there ient for the production of a large surplus.

l of Preparation and Use as Food.—When the cacao carefully gathered, they are cut open, and the seeds, covered with a slimy pulp, are put in piles to ferment, which in the course of a week disposes of the pulpy of the seeds and cures them ready for drying and ship- hen carefully fermented the seeds are twice as valuable arelessly done.

differs from tea and coffee in the manner of its use. used as decoctions made by steeping or boiling the d coffee berry in water, after which the leaf and berry n away. Cacao, containing the same stimulating as tea and coffee, has in addition many food elements erefore, a food as well as a drink. All processes of re merely grind up the beans, which we eat as solid as candy, or drink as a thick, brown liquid when h milk or water. This grinding may be done in the do the Chinese cooks in the Philippines who pound the

beans in mortars and flavor them with spices to suit individual tastes. In the western world the beans are taken to the great factories of Holland, England, France, Germany, Switzerland, or the United States, where expensive machinery pulverizes the beans to great fineness, mixes the powder with sugar and sometimes also with milk. This use of milk requires many chocolate factories to be near dairy centers and it even causes the location of some plants in the country towns of dairy districts, as in eastern United States and Switzerland.

The so-called breakfast cocoa differs from chocolate by having the nourishing fat, or cocoa butter, removed to make it more easily digestible. This fat comprises about 50 per cent of the bean, whose great richness helps to explain the necessity of fertile soil for the growth of the tree. The fat is valuable in medicine and has the peculiarity of never becoming rancid no matter how long it is kept. Examination of the table of food values and the comparison of chocolate with our staple articles of diet will show its great value as food. It is several times as nutritious as eggs and about two and one-half times as nutritious as beef. These are significant facts when taken in connection with the relatively declining quantity of beef, the increasing quantity of cacao (50 per cent in five years, 1906–10) and the indefinite room for expansion in its production. As the cost of cacao production is estimated at four cents a pound in Ecuador and the price is several times that, there is good reason to expect the production to increase in response to demand—quite different is the meat situation.

The great cacao markets are first, Hamburg (Germany is a great cocoa user), second, Havre, third, London, and fourth, New York, from which cities it is distributed all over the western world.

4. SPICES

Despite their non-nutritious character spices are so generally prized as an article of diet as to be of nearly world-wide interest. In the history of commerce they are of especial interest because the trade in spices long dominated the commerce between the East and the West. They were for centuries the only food

that could be transported far and they were of greater importance in the diet of ancient and mediæval peoples the small variety and poor flavor of their food made a necessity for something to improve its palatability.

the Product of Tropic Garden Spots and Hives of on.—Practically all the spices with the exception of are limited in their production to the tropics. The fruits from which they are produced have been widely ated throughout the hot countries, their growth is common, but the commercial production of the spice llows the mere introduction of the plant for local use. ue to the fact that nearly all the spices are like tea in tedious and painstaking labor in their production. lt their export is limited to centers of dense population labor supply. It was the spice trade that Columbus nd spice trees were among the early introductions to the ld. While the New World took the Old World grains e and now dominates in the export of these products of pulations, our export of spices yet remains insignificant.

.—This is the most important of all spices. It is ike by rich and poor in both tropic and temperate In quantity it equals all of the others combined. is the greatest pepper-exporting port. Most of this assembled from Malacca, Sumatra, Borneo and Siam, is also grown about Singapore. It is significant to is connection that the population of this island of 206 les is 230,000 people, a large proportion of whom are olies, the best laborers in all the tropical world. With many Europeans—a combination providing both nd supervisors. Siam also has at least 200,000 Chinese nity of Bangkok. The Chinese coolies are also responost of the pepper and other exports of Sumatra. The oast of India is another pepper country and a little is iced in the West Indies.

epper is the dried, unripe seed of a climbing vine and pepper is the same seed riper and with the skin peeled common method of growing this plant is to sow the elds of rice, castor beans and other temporary crops. e time the seeds of rapidly growing trees are sown. In

two years these trees are cut and stuck in the ground as poles, making a permanent support for the climbing pepper vine, which yields its crop in about two years.

Cayenne pepper or Chillies is an entirely different plant, yielding a small fruit something like the peppers commonly seen in temperate-zone markets. It is widely grown for local use throughout tropic Asia and Africa and in South America, and properly takes its name from the city in French Guiana.

Ginger.—This, the second spice in the order of demand in the market, is the underground stem of a reed-like plant growing wild in the warm parts of Asia. It is one of the most widely cultivated spices. It is planted like any common crop, dug in ten months, and like most spices, dried in the sun. The best preserved ginger is exported from South America, west Africa, Bengal, Cochin China, and to a small extent, from north Queensland.

Cinnamon and Cassia.—Cinnamon is the bark from young shoots of a small evergreen tree native to Ceylon and the adjacent coasts of India. It was a government monopoly in Ceylon until 1833. Since that time it has been introduced in Java, Cape Verde, Brazil, West Indies and east Africa, but almost the entire supply is still produced in certain districts of southeastern Ceylon where 40,000 acres are under cultivation. This island has the necessary warmth, moisture and light sandy soil, and over most of its territory a population ranging in density from 200 to 600 per square mile, thus furnishing the labor supply necessary to keep the cinnamon trees trimmed to a low bush-like form, to gather the long shoots, peel the bark from them and dry it ready for market. The flavor of cinnamon, like most of the spices, is due to an essential oil. Cassia, the bark of a somewhat similar plant, is much like cinnamon, is gathered in the same way but is of inferior quality, and is largely used to adulterate the Ceylon article. Most of the cassia is produced in the tropic part of south China and the exports, amounting to a million dollars a year, are all sent out through Hong Kong.

Nutmegs and Mace.—Mace is the husk around the nutmeg, the fruit of a tree growing wild in the Banda Islands in the East Indies. This spice tree, with the clove, was long a monopoly of the Dutch government in the Moluccas or Spice Islands, where

ɪh traders in the days of their commercial supremacy l their spice monopoly by sailing the eastern archipela- cutting down spice trees wherever they found them. are now chiefly grown for export in Singapore and the f Penang, East Indies (107 square miles, 906 people per ile), and Granada, West Indies (270 square miles, 500 er square mile). The population of Penang is largely which conduces to production. In addition to nut- e little West Indian isle of Granada exports cacao e minor spices.

—This hot spice is the dried, unopened flower bud of a m to some extent in Penang but most largely in the Zanzibar (640 square miles) on the eastern coast of here the population of 270 per square mile has a con- sprinkling of East Indians, Europeans and Arabs, who mployers of labor. The oil of cloves is often extracted spice and sold as a separate product.

.—Vanilla differs from the other important spices in ɪative of America-Mexico. It is cultivated to a small the eastern coast of that country, but this cultivation ally captured by the Oriental labor supply, situated lian Ocean islands of Reunion, Mauritius and Seychelles. ands resemble other spice districts in population. (200 people per square mile) has a considerable sprink- indoo, while Mauritius (500 per square mile) has an t element of Chinese. The growth of vanilla is very It is an orchid-like vine and must grow in the shady id forests. Owing to a peculiarity of the blossom, must be fertilized by means of a small splinter of wood nd of the attendant. After the beans are ripe, they most carefully dried to maintain the perfect flavor. ɪfacture of vanillin, a substitute produced from sugar ɪlysis, threatens this industry.

o or Allspice.—This fragrant spice is the small dried led fruit of a beautiful tree which grows to 30 feet in a native of tropical America, and cultivated chiefly ɪnd of Jamaica (population over 150 per square mile ɪntainous territory). The pimento trees commonly astures and at picking time small boys climb the tree

and break off the fruiting twigs. Women pick them up from the ground and attend to the work of drying and preparing the fruits for market.

Mustard.—Mustard is the most popular and extensively used spice in Great Britain, and is quite generally used in other countries. It is the finely powdered seed of a plant belonging to the same family as the turnip and beet. The production of this seed is quite widely scattered, and seems to be centered in localities possessing the necessary foggy climate that favors its best development; thus certain foggy districts in western Russia have developed a relatively large mustard industry, the product being exported through the adjacent German port of Königsburg. In Essex and Cambridgeshire, England, and in Holland are other mustard-growing districts. The United States has one successful mustard district near Lompoac, in Santa Barbara County, California, in a valley opening directly to the Pacific, whence come the necessary fogs at the ripening time. The attempt to develop mustard production in sunny districts east of the California Coast Range has resulted in lamentable failure, although the crop was promising to within two weeks of harvest.

An inferior quality of mustard is also exported from Bombay, India, where the climate renders the seed too hot to be generally acceptable.

5. TOBACCO

The Use, Spread, and Consumption of Tobacco.—No text-book for use in Europe or America need tell of the uses of tobacco, except to refer to some of the newer ones, such as the utilization of tobacco waste as fertilizer and insecticide. The dust made of stems is a fertilizer rich in potash and is also used to kill the aphis on the roots of fruit trees. The nicotine, which is the cause of opposition to it, has of late given rise to the manufacture of poisonous fluids for use as sprays in exterminating insects. Columbus and his fellow discoverers found tobacco in use among the American Indians. When carried back to Europe, its use was opposed by priest, pope, king, and emperor, and the czar of Russia once laid even the death penalty upon its use. Medical and athletic professors oppose it, but none the less its use has

ter than any language or religion, and is found through-
ealms of civilization and barbarism. The Dutch and
consuming respectively 7.5 and 6.2 pounds per year
, use it more than any other peoples, probably because
early acquaintance with it as traders. The United
next, credited with 5.7 pounds per head; Germany
nds; while England has less than 2. The increase
has been surprising.

CAPITA CONSUMPTION OF TOBACCO, POUNDS

	United States	Germany	France	Great Britain
	1.6	2.8	1.7	1.2
	4.6	3.3	2.0	1.4
	5.1	3.6	2.4	2.1

nmercial plants grow over so wide a range of the earth's
It is injured by frost, but it grows in a comparatively
on, so that profitable crops ripen as far north as Wis-
uthern Canada and England, while it is at home
t the tropics. Probably no other commercial product
more grades and commercial varieties. One field of
obacco may be classified into as many as seventy-two
narket kinds. The quality of the soil affects it in a
e degree, as does temperature, humidity, and especially
ntation and chemical changes that take place in the
curing the leaf. The resulting strength or weakness
the kind of flavor, the thickness, brittleness, elasticity,
olor, size, perfection and relative weight of leaf, its
dustiness, gumminess and ripeness are some of the
at decide whether the tobacco will bring two cents or
und.

's Commercial Service.—The commercial service of
as been great. The Jamestown Colony in Virginia was
ail in its early days because the settlers could find no
op, nothing to sell to the mother country in return for

the imports that they must have. England, being then essentially an agricultural land, had an abundance of wheat, oats, barley, rye, and all agricultural staples as well as manufactures. The company that founded Jamestown imported Italian experts and tried to grow silk, but failed. The grape also failed, and

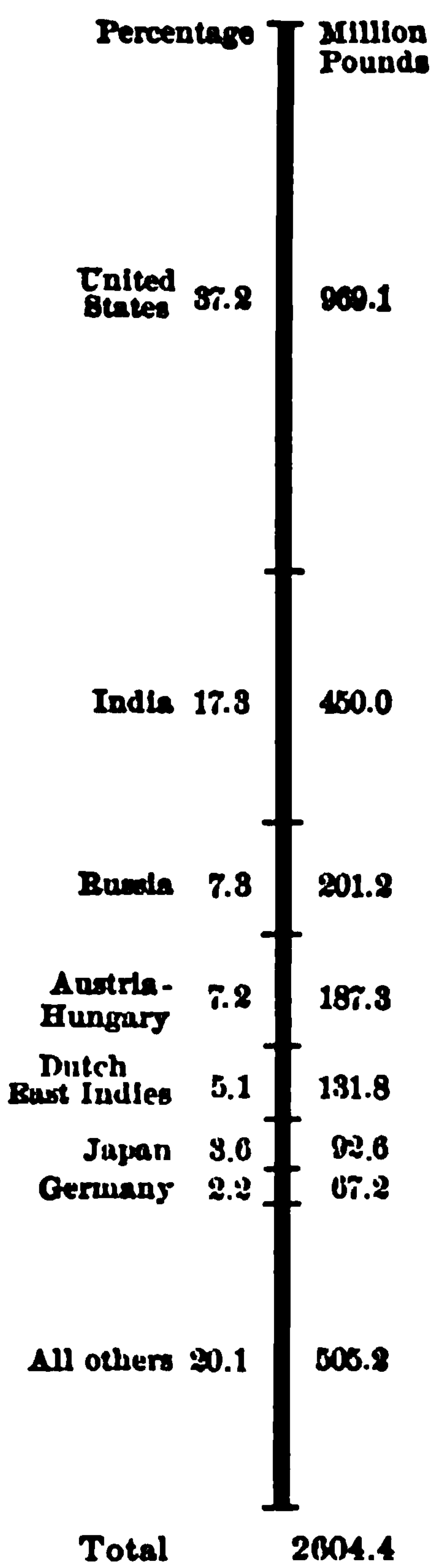

FIG. 105.—World's tobacco production, three-year average, 1908–10.

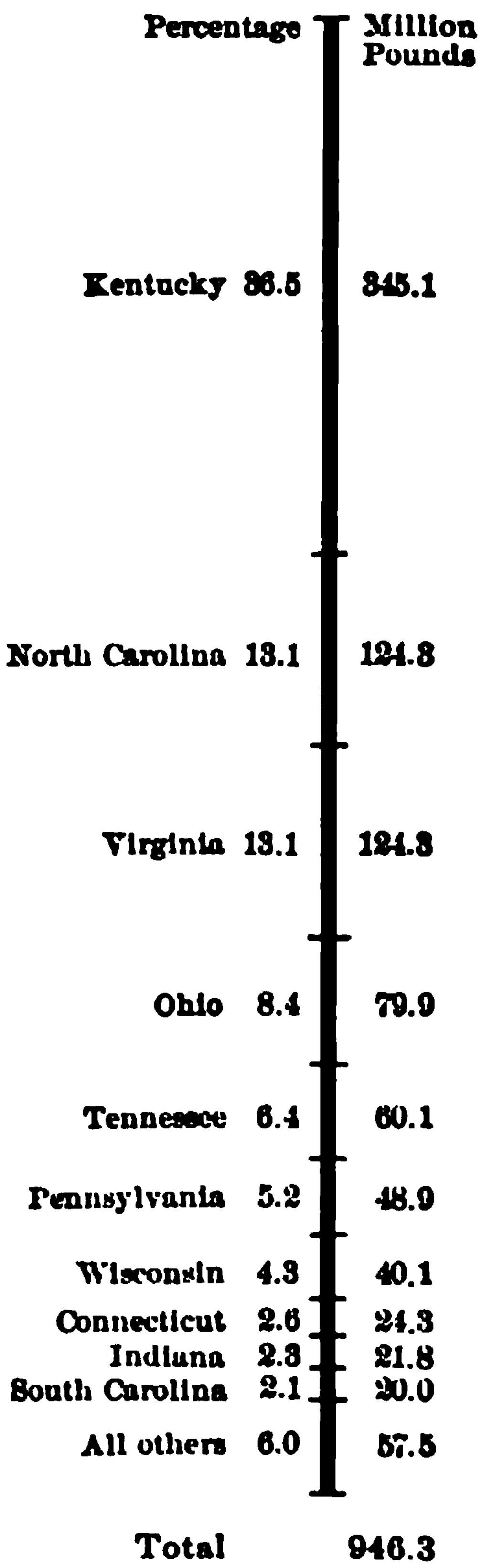

FIG. 106.—United States tobacco production, three-year average, 1909–11.

with it went their hopes of a wine industry and the colonists had been depending on those two luxuries, for which there was a good market in England. Despair ruled in Jamestown and talk of returning to England was rife. Then a trial shipment of tobacco which the Indians had shown the colonists how to grow

a good price in England and spread industrial hope in where there was unlimited land suitable for tobacco. ıtly became the great staple of trade, remained so throughwhole Colonial period and to a very considerable extent the present time. It was so important as to become a of currency in the Colony of Maryland in 1722 and the ıd all other public officials received their pay in tobacco. ıs 1810 it was one of the few crops that could be sold by le of Kentucky and Tennessee, whose export market was ɜans reached by flat boats down the Ohio and Mississippi At the founding of our government its export of over ɔn pounds was one-third as great as it is now.

ɔo Injury to American Soils.—The ready market for n Europe has resulted in great injury to the soil resources American tobacco-growing districts. For centuries it the custom of European planters to raise wheat or other rain, such as rye, one year, followed the next year by wn grain, like oats or barley, and the third year the land ed and let lie idle or fallow, before entering again on the r rotation. But in America the crop of tobacco took of the fallow year and, because of the good profits, vas even grown year after year until its great demands h exhausted the soil for a time and the field was often ·d because land was so cheap that more could be had by .own and burning the forest. Then the heavy downthe summer thunder showers reduced the abandoned ield to useless gulleys before the old field pine could ke a forest there. This wasteful policy brought great ɔ southern Maryland and middle Virginia, and from ions the people emigrated in such large numbers shortly Civil War when western farm lands were opened up, e was a general loss of population throughout the old ɔbacco district, which to-day has less land in cultivation ıd a century ago. Although it takes unusual quantities from the soil, the destruction of soil fertility does not y attend the growing of tobacco if proper crop rotation ·d. This has been proved in many places, notably by the f Lancaster County, Pa., and other parts of that state, endid crops of tobacco are grown on small farms pro-

ducing wheat, corn, hay, and cattle, the tobacco being grown on the same land only once in a period of six or seven years. For the three years 1909–11 the average yield per acre in Pennsylvania was 1,300 pounds; in Virginia but 785 pounds. But the report of the Secretary of Agriculture for 1907 (p. 77) states that "In Virginia . . . . . by the proper handling of the soil through modern methods of culture and of fertilization, the lands have been left in so much better condition after the tobacco crop has been removed, that without further special treatment the yield of subsequent crops of wheat has been increased three fold and the lands have produced heavy crops of hay where formerly this crop was not even considered a possibility." This unfortunately was the description of a few scientifically operated farms, not the description of a state.

Tobacco an Intensive Crop.—Because of the great labor in its production and the small yield, a pound of tobacco is worth many times as much as a pound of hay or grain. It belongs to intensive agriculture. The tiny black seeds, three or four hundred thousand to the ounce, are sown in seed beds, and the little plants were, until the recent introduction of a new machine, transplanted by hand to their place in the field, where constant attention and hand labor are necessary to protect them from the cut worm which cuts off the young plant, the leaf worm which eats holes in the leaves, the stalk worm which destroys the central stalk of the plant. The blooms must be picked off, so that the energy may go to leaf rather than seed. For the same reason, the suckers or side shoots must be pulled off, while the process of picking, curing, sorting, grading, and packing, is laborious and requires skill. The farm value per acre in 1910 was $74, that of wheat $12.63, and that of hay $16.30. The United States crop of 1911 was worth $85,000,000—more than one-seventh the value of the wheat crop, but grown on one-forty-eighth the area. The entire American crop of approximately a billion pounds in 1910, nearly 40 per cent. of the world's crop, is grown on 1 1/4 million acres (2,000 square miles)—slightly more than 1 per cent. of the corn area. As much of the labor of tobacco growing requires watchfulness and care rather than strength, it can be done by women and children as well as by men, and as a result it is rarely grown on an extensive scale and is usually grown by

›ers of the farmer's family, who care for a small field. cco farmer of Virginia and Kentucky usually raises orn to feed the horses that work his lands, the pigs › his meat, and the cow and chickens that help feed the He sometimes also raises some other supply crops, s money he usually expects to get through the sale of

ading Tobacco Belts of the United States.—For a long Virginia-Carolina tobacco belt running from southern through the middle part of Virginia and North Carolina ading tobacco belt of the United States, but Kentucky become the first state, producing in 1911 over three- much as all of the states east of the Appalachians. estone lands of Kentucky are the chief seats of tobacco a, and Louisville, their natural commercial center, is əst tobacco market in the world. Much Kentucky exported to European countries, for the United States the greatest exporter as well as the greatest tobacco the world. Large amounts of tobacco are also manu- in Louisville. In the eastern field, Richmond is the enter, while Petersburg, and the Carolina towns of ›alem and Durham have enormous tobacco factories very complicated machinery, cigarettes, smoking and ›bacco, and snuff are manufactured for shipment to all ıe United States and for export.

ıor Tobacco Belts of the United States.—The growing is widely scattered in this country, small but important 'owing districts being found in the Connecticut River Connecticut and Massachusetts, in southern Wisconsin, na where the famous "perique" is grown, and since orida. Experiments with the seed of the high-priced obacco showed that with shade it would grow well, so ›o planted that thin cotton sheets can be placed over ften the rays of the sun and make a more even tempera- more uniform humidity. Despite this great expense ›ss has proved profitable in Connecticut and Florida. ›acco as well as the Sumatra has been grown in Florida rtificial shade method has been copied in Cuba and ›. The effect of these innovations is shown in an acre-

age value in Connecticut of $333 in 1911, while the great crop of Kentucky averaged but $68 per acre.

Tobacco in Cuba and the West Indies.—Cuban tobacco is famed throughout the world for its fine flavor, being much prized for cigars, and chiefly used in the manufacture of the famous Havana cigars. The amount produced is about half as great as that of Virginia. The Havana tobacco is the peculiar product of the south slope of the Sierra de Los Organos, a mountain range running from east to west throughout the whole length of the Province of Pinar Del Rio in the west end of Cuba. Tobacco is

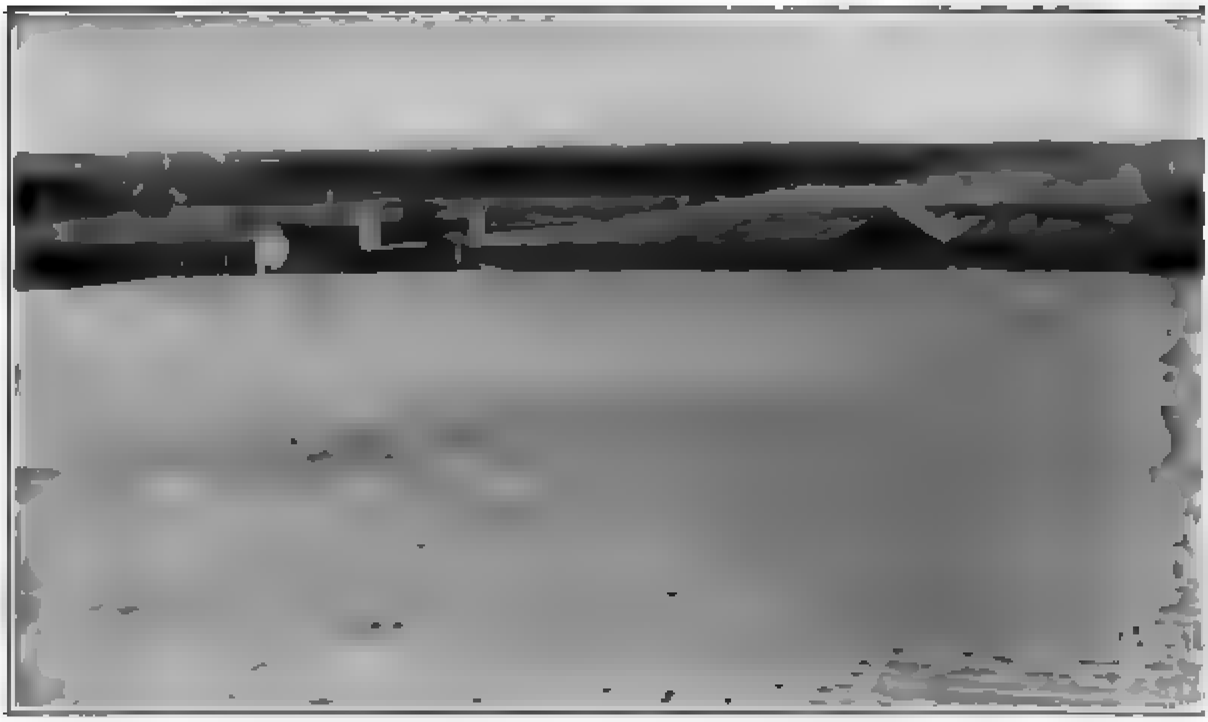

FIG. 107.—Plantation of cigar wrapper tobacco grown under artificial shade in Norfolk, fine sandy loam, Florida. (U. S. Dept. Agr.)

the one means by which the people of this district, called the Vuelta Abajo, are now able to buy products of the entire world. Innumerable attempts to grow the same tobacco in other parts of Cuba and other countries have resulted in failure, the nearest approach to success having been the shade-grown Florida product. The secret of its high quality is not known. It may be the protection from northern winds or some quality of soil or some effect of fermentation in curing. Most of the Cuban tobacco is used for cigars and Havana is a great cigar-manufacturing center.

The American tariff on imported cigars and tobacco has

building, largely by Cubans, of the cigar-manufactur- Key West on a little coral reef, 90 miles from Havana, ; spot in the United States to which the Cubans could ke advantage of the high price permitted by our tariff. is exported from Porto Rico, but San Domingo on the f Hayti is, after Cuba, the largest exporter of tobacco ıt Indies.

In Sumatra and the Orient.—Sumatra tobacco is ban in being of high value. Its thinness and elasticity ıt excellence as cigar wrappers, while the Cuban excels iller. The growth of Sumatra wrapper tobacco is rely new, being due entirely to the enterprise of Dutch and managers, a single company of Dutch capitalists ıployed in the island of Sumatra as many as 16,000 ith 200 skilled European overseers. This Sumatra lt lies on the eastern plain extending 5 or 10 miles n the Straits of Malacca. Practically all the labor is Chinamen, who, under the supervision of the Dutch have cleared the virgin forests and have taken such rops of tobacco from the rich volcanic soil that some ıpanies have paid as much as 75 per cent dividends A small amount of tobacco is grown upon the plains ıt the export is small.

India produces about half as much tobacco as the ıtes but it only amounts to 1 1/2 pounds per capita tle of it is exported. Japan grows about 100 million l/2 pounds per capita, but it is all kept at home and ıported. Its growth for local use is quite general ; western and southern Asia.

lippine tobacco bears the same reputation in the rld that the Cuban tobacco does in the western world port (20 million pounds) is about half as great. The is grown in the northern Province of Luzon in the he Cagayan River, which keeps the tobacco lands fertile by the layer of mud deposited in the annual This tobacco is shipped from the port of Aparri to ıere many persons are employed in making it into ıown Manila cigars. The poorer tobacco from the hilippines is sent to Spain.

European Tobacco Production.—Tobacco is grown in many parts of the continent of Europe, but on account of large population the quantity is insufficient for local use. Even Russia (crop 200 million pounds), the leading tobacco-growing country of Europe, and Germany, the third tobacco grower with a crop of about 65 million pounds, import nearly three-fourths of the amount used.

Tobacco has been a fruitful source of taxation. In Britain the tax is eighty cents per pound, and, to make the taxation easy through collection of imports at the Custom House, England for centuries forbade its growth, but its cultivation now seems likely to be encouraged. France to-day taxes it heavily, and will only permit it to be grown in certain localities where large amounts can be produced and the collection of taxes made easy. Spain gets most of her tobacco from the United States and the Spanish Government raises revenue from it by selling the monopoly of the sale of it to one company, which by its pay-roll supports 50,000 families. Turkey is the only European tobacco exporter of importance, although the crop of the whole empire is only half of Russia and a tenth that of the United States. The mild flavor of the Turkish product, like that of Asia Minor, makes it desirable for Turkish cigarettes. The so-called Egyptian cigarettes are made by Greek women in Cairo partly of Turkish and partly of Egyptian tobacco. A small amount of tobacco is exported from Algeria to France.

South American Tobacco.—Brazil grows enough tobacco along her eastern coasts for her own large home consumption, and an export (75 million pounds) that makes her the third tobacco exporter of the world, the Dutch East Indies being second. Ninety-five per cent. of the export is shipped from Bahia, where the foreign commission houses advance the money to the growers, who are always in debt, and take the crop in payment for the loans. It is not grown on plantations, as in Sumatra, but by the families of small farmers who get but 300 pounds per acre—a very low yield (Pennsylvania 1,420 pounds). Tobacco growing has declined in San Paulo from the competition of coffee, but its growth is increasing in the south of Brazil in the state of Rio Grande do Sul. Practically all of the Brazilian tobacco export goes to Bremen, one of the great tobacco markets.

and Colombia have a small tobacco export which is ing illustration of the commercial service of the plant. tricts in Colombia, tobacco, wrapped in bales covered two layers of raw ox hide, survives the humidity of , the downpours of frequent rains and the hardships acident to weeks of ox-cart and mule-back transporta- hide-covered bales are a common sight in the tobacco Europe. The people of Paraguay, men and women among the greatest smokers in the world; they also plus of tobacco which partially supplies the Argentine Some tobacco is grown in Argentina, but its increase owing to the demands for labor in other production. e to Central America and Mexico tobacco growing e is common.

a Tobacco Markets.—The British tobacco market is lmost entirely from the United States. Germany st of the South American product and much from the tes, distributing it from Bremen throughout Germany, rway, Sweden, and Switzerland. Amsterdam is the rs for the companies owning the Sumatra plantations r the sale of Sumatra tobacco.

Manufacturing.—Plug tobacco and smoking tobaccos ishable forms) tend to be prepared in large factories enters of production. Cigar making, on the contrary, ollow the market for several reasons. Cigars are keep, bulky to transport and require more labor forms of tobacco manufacture.

aking is one of the industries in which so much indi- s required that machines have not succeeded in re- man labor. The very simple apparatus commonly sts of a chair, table, and knife. Hence cigar making es place in towns in populous country districts like stern Pennsylvania or in great cities like New York, ia, and Chicago, where labor is abundant and the prod- o be near the centers of consumption and distribution.

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CHAPTER IX

FISHERIES

d Marine Plants.—Unless we value it for transportation
e of rainfall, the sea is very barren. It covers three-
the world's surface, and furnishes but a small propor-
r food supply through fish, which derive their support
vegetable life of the waters. Even the clear water of
as countless millions of minute plant organisms which
by many small animal organisms, they in turn are eaten
ther and by the smaller fish, and they in turn by the
, but the support of the whole pyramid of marine animal
he life of land animals, is based upon vegetation.
rd fishery is applied to the catching of practically any
at is taken in the water, as oysters, lobsters, whales,
seals, which are often taken on shore.

a of Fisheries to Sea Faring.—Sea fishery is considered
that first led man to sail upon the ocean, and from this
all maritime nations have had their rise. Such was
of the fleets of the Phoenecians and the Greeks who laid
ations of Italian cities. The Norseman on the inhos-
ores of Scandinavia developed fleets where man must
rve. The Dutchmen who wrested the commercial su-
f the world seas from the Portuguese had had centuries
le training on the herring banks of the North Sea. In
a of the importance of fisheries to Dutch welfare there
year for centuries a national celebration in which one
t important ceremonies was the public eating of a salt
the Dutch ruler. The fleets of England had their
hese same fishing banks of the North Sea, and later the
anders became the pioneer seamen of America because
ng banks were near them. The schooner, the fastest
ng vessels, was invented and is yet used by the fisher-
oucester, Mass., and in recognition of the importance

of the sea industry to the state, a dried codfish has, since colonial days, hung over the desk now occupied by the speaker of the Massachusetts Senate.

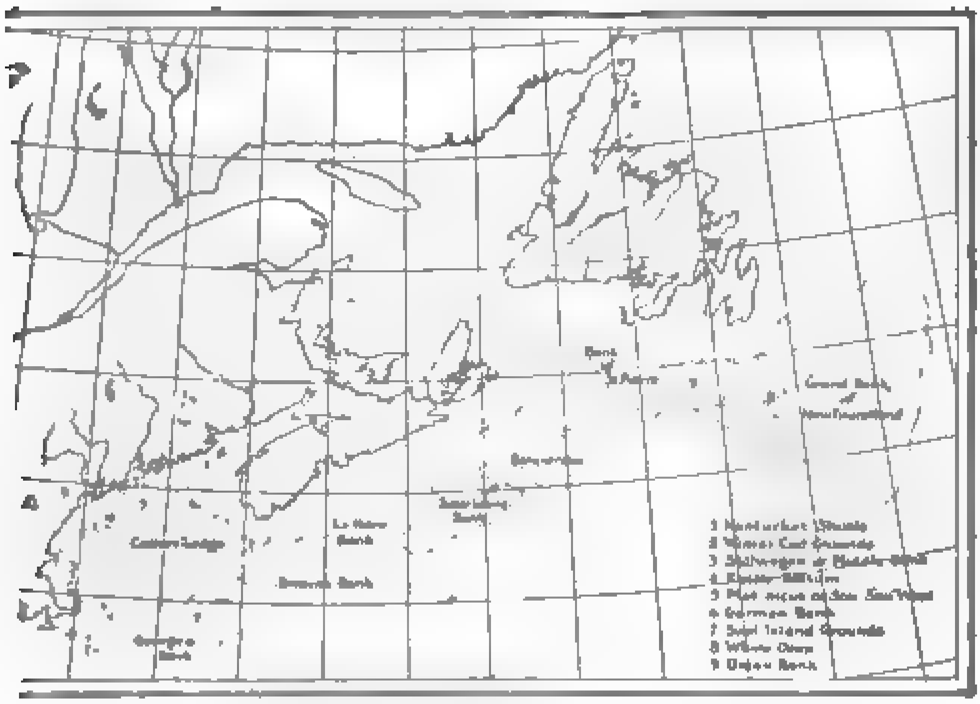
The fishing industry, through its connection with sea power and the romance and charm of the ocean, tends to be overestimated in its real importance. All the fish that are caught by American fishermen ($54,000,000, 1908) are less valuable than the tobacco crop, not one-third as valuable as the pork, not one-fifth as valuable as the butter, not one-tenth as valuable as the poultry and eggs annually produced in the United States. The fish of all the world are only two-thirds as valuable as the poultry and eggs of the United States.

The Locating Factor of Fisheries.—Most of the world's fishing industry depends upon two habits of fish which enable us to catch near the land those that may have passed most of their lives hundreds of miles away at sea. The first is the spawning habit of many species which lay their eggs only in rivers or in the shallow waters near the shore. The second is the congregation of fish to feed upon the bottoms, in shallow waters, commonly called "banks." The occurrence of such banks near the shores of northeastern Asia, northeastern North America and northwestern Europe is responsible for the three greatest fishing regions.

North Atlantic Fisheries of America.—The fisheries of northeastern North America are based on a rich combination of rivers, bays and shallow off-shore banks. Especially important are the grand banks of Newfoundland and smaller banks off Labrador, New England and New Jersey. The Newfoundland banks were known to the fishermen of the French province of Normandy and Brittany within a dozen years after Columbus had returned to Spain from his first voyage. Unquestionably the knowledge of these fishing banks made a greater sensation in Europe than the mere fact of the discovery of the new continent, because at that date Europe was poorer than now, and a new food supply was important. In that day the fishing industry was relatively more important than at the present time. Practically the whole of Europe was Catholic, and even to those who could afford it, there were many fast days upon which fish must be eaten in place of meat. Scores of vessels sailed back and forth from France to

foundland banks each year for a century before the
de settlements in the St. Lawrence valley.

Fisheries.—The most important fish on these and
hern banks is the cod, a fish which feeds along the
d is commonly caught on a "trawl" which consists of
ks attached to short lines that are fastened at intervals
a longer line sometimes 3,000 feet in length. These
attended to by fishermen in rowboats called dories
ut from the schooners. The men in the dory take up
the trawl, which is anchored and marked by a float,



Map showing (by broken lines) principal fishing grounds off the
England, Nova Scotia, and Newfoundland. (After MacFarland.)
Tower.)

at along under it, and let it down in the water again
sh have been taken off and the bait replenished.
he Grand Banks is an exceedingly dangerous calling,
s are one of the foggiest places in the world and the
ften collide with each other and with the icebergs,
the dories often lose their bearings and drift away to
a single fearful storm sometimes drowns scores or
ds of fishermen. To complete the chapter of dangers
banks are in the path of transatlantic vessels which
e small fishing craft in the fogs.
ks have enabled New Englanders to catch fish of as

great value as all the rest of the United States together. Massachusetts and Maine are the leading states, and Gloucester, Mass., was long the greatest fish port in America, nearly the whole population being engaged in the catching, curing, buying and selling of fish. Boston with its better marketing facilities has recently surpassed Gloucester as a fishing port.

The cod fisherman also catches halibut and hake. The American catch of these fish is actually greater in quantity, though less valuable, than the catch of cod. The cod is at its best in cold waters and is taken in greater quantity by the Canadians than by the New Englanders, and the people of Newfoundland and Labrador catch more codfish than all the rest of the people of America. Dried cod makes nearly two-thirds of the exports of this northern dependency of Great Britain.

Newfoundland and Labrador offer one of the best modern examples of a people living from one resource—so great is their dependence upon fish. There is a little iron mining, a little lumbering, and paper making, but eight-ninths of the exports are fish products and nine-tenths of the workers are busy with fish.

The climate is so cold and damp that there is practically no agriculture, a garden even being a rarity in Newfoundland. The people who are not at sea catching cod, or herring, are busy curing them. Some of the cod are sold fresh, but most of them are cleaned and salted as soon as they are brought to the schooner by the dories, but when the schooner reaches its port they are dried in the sun upon sheds which stretch conspicuously along the coasts. The herring is salted or cured by smoking over a slow fire after being salted.

The Nova Scotia fishing industry with a catch of $7,000,000 per year, equals that of Massachusetts, the leading state of the United States, and the total Canadian catch ($25,000,000, 1907) is slightly greater than that of New England. Nova Scotia with her many good harbors partakes somewhat of the character of Newfoundland but, though she catches nearly one-third of the fish of Canada, the warmer climate of this Province enables the people to engage, to a considerable extent, in agriculture, and they ship sheep, cattle and horses across the straits to the people of Newfoundland.

shing Fleets in American Waters.—Fishing fleets still visit the Grand Banks, and although New-ongs to Great Britain, the French fishermen may t fish along the shore of the greater part of New-They may also land and although no permanent ments may be made. ns two islands, Miquelon e, situated just south of d, with a population of a dependent entirely upon dustry. This single prod-o give these islanders a rade exceedingly heavy, as heavy as that of the s.

ropean Fisheries.—The he greatest fishing ground It is very shallow and shing banks. It is sur-populous lands, being reach of the British, gian, Dutch, German, ish, and Norwegian fish-elongs alike to all of them, custom of nations, the sea d more from shore is free d. These peoples having North Sea catch about worth of fish per year, and rt of them come from the Britain with a catch of er year is the second fishing nation of the world, l of the United States.

thousand men are engaged, and fleets of vessels, ers, have their headquarters at Aberdeen, Hull, westoft, Yarmouth, and at London, which is the market in the world. The Dutch, by their location nt upon the North Sea than are the British, fish

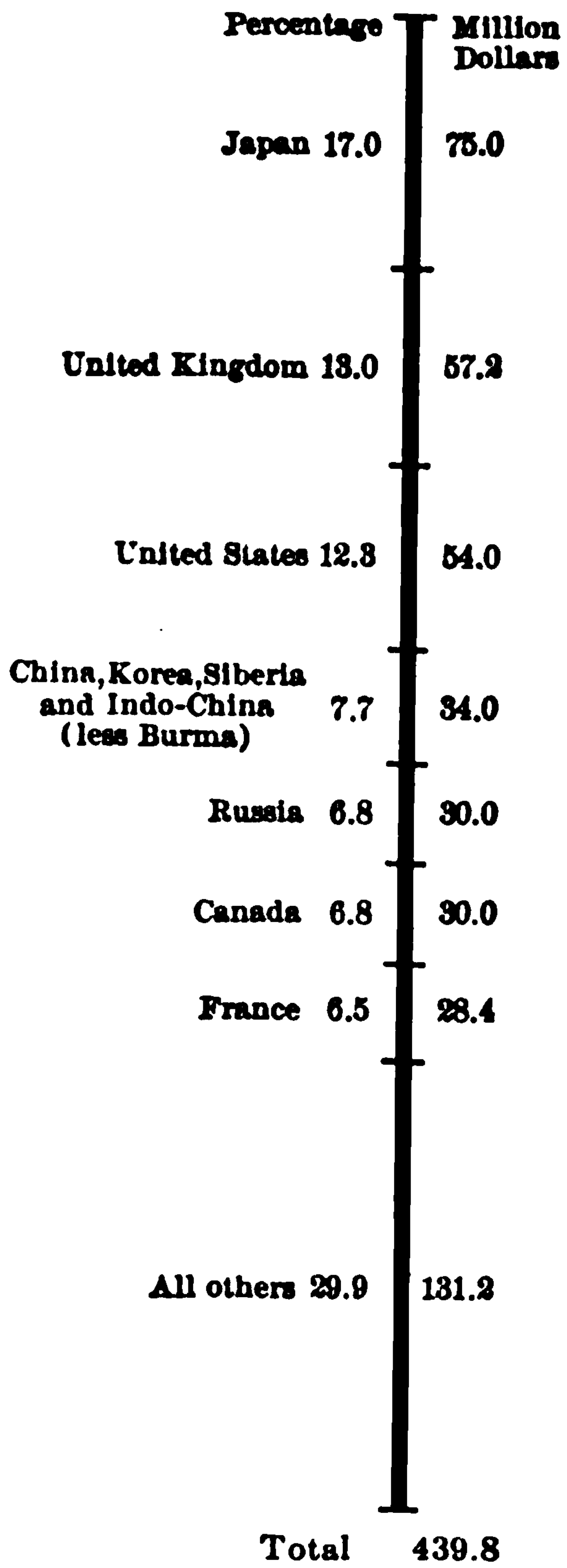


FIG. 109.—World's fishery products.

nearly as much per capita as the British and have a fishing fleet with 20,000 men. The French, having no fishing banks along their coast, sail as far away as Newfoundland and Iceland.

In Iceland, Faroe and other islands west and north of Scotland, fishing is an important industry, but Norway is of all the nations the most dependent upon fish. With its cool climate, its mountainous rocky land, and its coast full of bays, it duplicates in many respects Nova Scotia, Canada and Labrador, and like them has great fisheries of cod and herring. The cod are caught near the Lofoten Islands and the herring in the bays about Bergen in southern Norway. The catch of fish is about five times as great per capita as in Great Britain. Fish and fish products make up more than a third of Norway's export, and Norwegian codfish, codfish oil, and herring are known in many lands.

Fisheries of Japan.— The third fishing region of importance is on the coasts of northeastern Asia, where again we have a cool climate and rough shores, such as prevail in the same latitudes in eastern North America. The Japanese are credited with eating more fish than any other people in the world. Two reasons account for this. One is the almost entire absence of the meat animals in Japan, and the other is the abundance of fish in the waters surrounding the country, which happens to be composed entirely of islands, thus tempting its people to go to sea. Yezo, the northernmost of the four large islands of Japan, is too cold for rice growing, much of it is too rough for any other kind of agriculture, so, its people like those of Norway and Newfoundland, have depended almost entirely upon the catch of cod, herring, and other fish of north temperate latitudes. The only other industries of Yezo are the coal, which does not depend upon climate, and the lumber, which grows upon the cool mountains as it does in Norway, Sweden, and Newfoundland. Of late, the scientific agriculturalists are discovering possibilities of wheat growing which will aid rather than hinder the development of fishing industry, by giving a bread supply at home.

Japanese fishermen scour the coasts of Asia, especially those of Korea, the Kurile Islands to the north, and Sakhalien, a barren and almost uninhabitable island on the Siberian coast, near the mouth of the Amur River. Half of this island the Japanese

ful to secure by treaty at the close of the recent Russian hus they guaranteed their fisheries, which furnish not chief animal food of 50 million people, but also an im- 'ertilizer, made of dried fish refuse and non-edible fish, isively used in the well-tilled garden-like farms of Japan.

sheries of the Open Sea.—Mackerel, unlike the cod, are wimmers, and are caught in nets swinging in the open y are caught off the coasts of Europe and the United d immediately salted.

r surface fish caught by nets as he swims near the sur- e menhaden, fished for chiefly off the northeast coast ited States within a hundred miles of New York. The considered good for food, but a valuable oil is extracted esh and the dry remains bring high prices as a fertilizer rogen and phosphoric acid. Floating fertilizer factories and down the coast manufacturing this oil and fertilizer menhaden brought in by the fishing tugs that operate

rdine, deriving its name from Sardinia, is a small pil- ed, packed in oil, and sold in sealed cans. It is exported om France, the sardines of the Mediterranean being r shipment at Beauclaire on the Rhone, while Bordeaux ns are two great centers upon the Bay of Biscay. Sar- lso caught along the coasts of Spain, Portugal, and Italy, d of sprat is often sold under the name of sardine. sheries reach their greatest importance in Brittany, the province of France, where the failure of the sardines in the neighboring seas for a season has caused as many persons to be in a starving condition, dependent for upon the donations of the French government. Along of New England, especially in Maine, there has long been ant industry in the so-called "American sardines" really small herring, a fish closely allied to the pilchard. the Maine sardine canners have to dry their herring cial heat while the Frenchmen can do it in the sun, the product is much cheaper, and is shipped to all parts of l States and South America. Of late years the canners urope and America have discovered that the cheaper l oil can be used in the place of olive oil in fish canning.

Whaling is of all fishing enterprises the least connected with home ports of ships and particular shores. It is also essentially an industry of the past. It was of very great importance in the first half of the nineteenth century, when whale oil supplied the family lamp. In those days New Bedford and Nantucket in Massachusetts and New London, Connecticut, were the great outfitting centers of an industry that was prosecuted in all oceans of the world so persistently that the whale was nearly exterminated by 1860, when the discovery of petroleum lessened the demand for whale oil. Some whale fishing is still carried on, but the whalers of Nantucket have changed their base to San Francisco, so that they may be nearer the home of the whale, now chiefly caught in the Arctic Ocean near Behring Straits. There is still some fishing in tropic waters for the sperm whale which has in his head a white mass called spermaceti, useful in the preparation of sperm candles and certain ointments. Dundee, Scotland, is, after San Francisco, the only other important whaling port.

Sealing.—The seal gets its living (fish) in the sea, rears its young upon the rocky shores and is the prey of man on both sea and land. It is such a valuable quarry that extinction seems to be its fate where not protected by strictly enforced legislation.

The great center of fur seal fishing is the Pribylov Islands, an American possession in the Behring Sea. Here each year many thousands of seals gather from distant seas, and remain for a few weeks during which time the seal pups are born and grow large enough to swim away with their mothers. Each year a certain proportion of the young males, two- to four-year old seals were killed according to strict regulations by a licensee who paid for the privilege. Most of the valuable skins have been shipped to the London market. Unfortunately for the seals no country has in past years had any jurisdiction more than three miles from its coasts, and the seal at sea was like the whale, beyond the protection of government. While the United States could and did protect the seals during their stay on the rocks of the Pribylov Islands, the mother seals daily swim to the open sea for fish, and during many months the whole herd is scattered widely over the Pacific Ocean. When more than three miles from shore they fell a prey to the rifles of the pelagic sealers from Canada, Japan or

ɔd States, who sailed the seas in search of them. As a
ı mothers of many little seals were shot while gathering
ring the young to starve on the rocks. Thus the num-
als in the Pribylov herds rapidly declined and extinction
nly a matter of years. To make conditions still more
ıte, five-sixths of the seals shot at sea sink and are never

ked and uncontrolled sealing practically exterminated,
ades ago, the countless thousands of seals that lived on
ninhabited rocks in the Antarctic, but a recent treaty
tween the United States, Japan, and Canada has prob-
ed repetition of such an economic insanity in the Behr-
This treaty protects the seals because the three nations
top pelagic sealing and the United States agrees to divide
ds of the monopoly which she holds because she owns
ookeries. As the seals are polygamous, a certain pro-
: the young males can be captured each year without
y lessening the rate of increase of the herd.

valuable seal sought for its oil and leathery skin is
n Labrador and Arctic America, and a fleet of steam
ls from St. Johns, N. F., on an annual fishing voyage.
sels have been known to bring back 30,000 skins.

nd River Fisheries.—A number of marine animals such
ster, clam, lobster, and sponge live in shallow waters
y can easily be caught. Many rivers and bays have a
lue out of proportion to their area because of the sea
nnually enter the stream for spawning and become the
st of the fishermen.

rgeon, the largest of these visitors, is a fish that grows
s 10 feet long and is found to some extent in the Ameri-
; Lakes[1] and the rivers of the Atlantic, especially the
but in greatest quantity in the Caspian Sea, whence
it ran up the Volga River in such quantities that at
r crowded each other out of the water in narrow places.
are caught for their eggs, which are sold as Russian
d the industry has been prosecuted so vigorously that

ıine fish, like the seals of the Caspian Sea, seems to have survived
me when these inland bodies of water were connected with the

this valuable fish is about to become extinct. The industry has practically disappeared from the Atlantic rivers of America and has greatly diminished throughout the world, but the rising price of caviar makes sturgeon containing eggs more and more valuable, and the quest more fierce—another example of the wanton waste perpetrated by men.

The salmon, of which there are several species, is easily the king of all river running fish. It is said to ascend only streams having their sources in lakes in which the females deposit their eggs. Salmon are found to some extent in northwestern Europe, New England and Canada, but the rivers of the north Pacific, between San Francisco and Japan, are the chief source of world's supply. In Alaska they have for an unknown period been almost the only food supply of the natives, who at the time of the annual run put away the year's supply of smoked salmon in little houses on high poles, out of the reach of wolves and dogs.

For many years salmon canning has been an important industry, first established in California, Oregon and Washington, then in British Columbia and finally in Alaska, where in almost every river, especially the great Yukon, salmon are exceedingly abundant. They run in great numbers and a common method of catching them for the cannery is by the fish wheel, a large water wheel revolving in the swift current and having wire buckets which catch the salmon and throw them into a boat below the wheel. Large salmon canneries have been built at the mouths of various streams in Alaska along coasts so rocky and cold as to be undesirable for human habitation throughout most of the year. As the season for the salmon running approaches, sailing vessels loaded with empty cans and carrying many workmen, usually Chinese, leave San Francisco, Portland or Seattle for the cannery. In a few weeks hundreds of thousands of pounds of salmon are canned, loaded into the sailing vessels, and brought back to the home port for distribution throughout the United States, the United Kingdom, Australasia, and to a lesser extent to many other countries. Salmon is the chief fish export of the United States (1911, 40 million pounds, $4,000,000).

The shad, probably the most highly prized of American food fish, ascends each spring the rivers from Florida to the St. Lawrence. North of the Delaware this fish is unimportant and the

ɪ of the Chesapeake furnish about one-half of the total The herring also ascends these same rivers in such num- t at times their scaly backs make the surface of the water almost like a mirror. These herring are easily caught, ɤd the small streams in such numbers that they squeeze water wheels that lift water from ɪf the Chesapeake into the Chesa- ɒd Delaware Canal, where, un- ɜscape, they perish by the thou- reating a nuisance by their de- odies.

Fish.—The oyster, of which the States has from five-sixths to ths of the world's catch, is the luable fish product in America, ɪg about one-third of the total all fisheries of the United States. cious shell fish lives on the sandy 'elly bottom of shallow bays and . It is found to some extent in lish Channel and the Bay of ɪnd on the Pacific coast of the States, but the numerous bays Cape Cod and Galveston, with ge expanses of shallow water of temperature seem to be the best the world for oysters. The ɪf best repute are produced be- ɪpe Cod and Cape Hatteras, and apeake Bay, an old river valley ɜh the sea has flowed, is the most ɪt oystering district of all, while ɪnd Sound is second. The mid- ɒtic states have two-thirds of

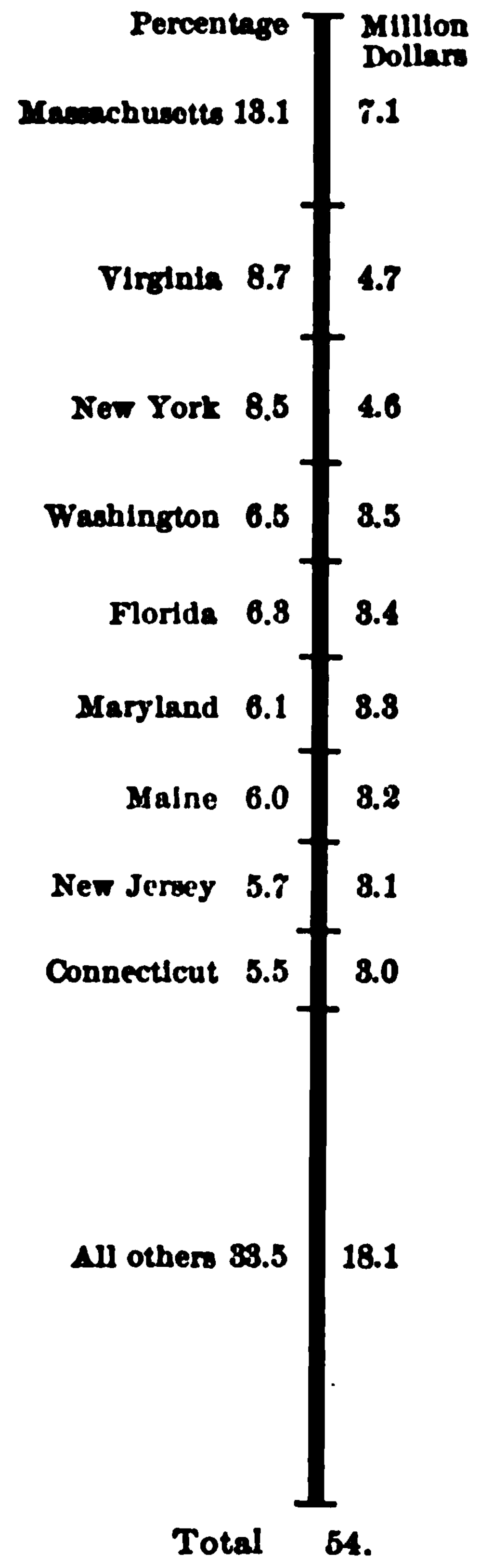


FIG. 110.—United States fishery products by states, 1908.

ɪ American oyster product. The oyster, after being from the egg, swims around for a time and then itself to some firm substance, such as gravel, an old ell or sunken wood. For two or three years he eats the tide brings him, and is then scooped up with long-

handled tongs in the hands of an oysterman or by a steam-drawn dredge. During the seven or eight months of the oyster season they are shipped in barrels and sacks to many parts of the United States and even Europe, while at Baltimore there is a large canning industry for shipment to small interior towns and foreign countries. The natural supply having been found inadequate, oyster culture has been established. Beds of young oysters are sometimes planted, that is, put down to grow large; another method is to lay old oyster shells and the bushy tops of trees upon the bottoms of the bays so that there may be something to which the floating spawn may attach themselves and grow. One great trouble with oyster planting is the ease with which a thief may carry off the product during a fog or at night, but the possibilities of the extension of the oyster industry in Long Island Sound, and in Delaware, Chesapeake and other bays are very great.

Clams and Lobsters yield greater cash return to the American fisherman than the codfish. The clam is a cousin of the oyster but possesses power of locomotion and is caught by being dug out of the mud. It is especially important along the New England and middle Atlantic coast.

The much-prized lobster, a great crayfish and cousin to the crab, lives along the seashore and, from the mouth of the St. Lawrence River to the mouth of the Delaware, is caught in a baited box trap called a lobster pot. The high esteem of the lobster causes it to bring about four times as much per pound as the codfish. The consequent keen prosecution of the lobster fishing has caused the passage of severe laws to prevent its extermination along the shores of the United States. Most of the present supply comes from Canada, the Newfoundland export of canned lobster being important.

The Sponge.—The sponge of commerce is the skeleton remains of a group or colony of animals whose fleshy bodies are washed out before the sponge is dried for shipment. The sponge grows at the bottom of warm shallow waters, the finest sponges coming from the Mediterranean coast of north Africa between Morocco and Tunis, and the Adriatic Sea. They are commonly found here to a depth of 150 to 200 feet and are brought up by divers. In the still, shallow water around the coral Bahama Islands and off the southwest coast of Florida near Key West they are

om the bottom by a fork attached to a pole 10 to 20 feet
Sponge fishing, combined with cigar making, is the chief
t of the city of Key West. Nassau in the Bahamas is an
ant sponge-fishing center. The growing scarcity and
ice of sponges are causing them, like the oyster, to be added
list of animals that grow under man's care—a piece of
ponge being tied to a weight and put upon the sea bottom
r.

Fishing is a shore fishery not possessed by the United
since the pearl is found in the shell of certain inedible
that inhabit tropic waters. The pearl is a product of
t, being deposited around some foreign substance that
ide the oyster shell. The output of pearls is, therefore,
in and often the fisheries are non-productive. The
earls and most important fisheries are upon the southern
' Persia in the Persian Gulf, where for ages this industry
n important. The shores of Ceylon also have a pearl
America has two pearl fishing centers, one in some
lands along the coast of Venezuela, where 1,600 people
ting $800,000 worth of pearls per year. The other
n pearl fishery is in the Gulf of California. In addition
ls, the mother-of-pearl, the pearl-like covering of the
f the shells of the pearl oysters, is a product of the pearl
A similar pearly shell used for button making is yielded
xtent of 40,000 tons per year, by certain mussels inhabit-
upper Mississippi River and tributaries.

mportance of Fish to the Atlantic Plain of the United
-In the central part of the Atlantic Plain of the United
unusual fish resources combine with many other resources,
the peninsula between the Chesapeake Bay and the
Ocean one of the most favored places in the United
the world for the easy support of the human race under
conditions that place no serious handicap on man. The
is wholesome, the varied soil, abundant, well-distributed
and satisfactory temperature permit the commercial
on of an unusual variety of grains, fruits, and vegetables,
h products reach their maximum of abundance. It is
test oyster, shad and herring locality and many minor
caught. Herring are so abundant that the laboring

man may in the spring time buy a thousand for from $2 to $5, and with a sack of salt and a barrel they can be preserved for the entire year. As herring and corn bread make a sustaining meal (materials costing two cents) for a working man, living is exceedingly cheap. The shores of these waters are in many places marshy, making excellent feeding grounds for wild ducks as they pass in fall and spring between the wilds of Canada and the swamps of the tropics, so that along the Chesapeake in addition to its resource of land and water, hunting is still an important source of support of the population because they can get ducks that, like the fish, are the emigrating product of another locality.

This peninsula differs but little from the tidewater region on the west of the bay and its advantages are in the main typical of the whole Atlantic coastal plain that extends from the fall line on the Atlantic rivers, to the ocean, and includes Long Island and Florida.

Fish in Southern Waters.—It is a fact that southern waters contain more fish than the colder waters of the north, but the heat causes fish to spoil quickly, rendering difficult the marketing of the product. Recent improvements in means of artificial refrigeration make it possible to catch fish in the teeming waters of Florida or the West Indies, freeze them at once, and market them weeks later in New York and Europe, in the same way that fish are now marketed in the winter season in those markets from the waters off Vancouver Island and other distant places. We may, therefore, anticipate a development of the fishing industry in southern waters.

Fish Culture.—Many centuries ago the Chinese and Japanese found out that fish growing in ponds and rivers is one of the easiest ways of getting meat in a densely peopled country. Oyster culture was an art among the Japanese a century before the Declaration of American Independence. The German people are also systematic fish growers, devoting themselves chiefly to the carp, a fish that can be fed in a pond like poultry in a yard. There are many fish growers' associations in the empire and the total area of fish ponds approaches 200,000 acres. In Saxony one-half of 1 per cent. of the area is covered with fish ponds. (Compare with the 3 per cent under cultivation in

. The fish are fed upon corn, vetches, potatoes, malt, slaughter-house refuse and many other foods. The yield is about 100 pounds of fish per acre per year and gher yields are sometimes made.

hreatened extermination of many valuable species of led to systematic fish culture which has thus far been evoted to fish hatching and caring for the fry for a short The United States government has a fish commission

-A new conquest of pisciculture. Bits of sponge wired fast to cement frames have grown nicely in Florida waters.

tches billions of fish eggs and releases the fry in streams s to replenish the supply. There are several salmon s in Oregon and Washington, shad hatcheries in the ivers, lobster hatcheries upon the New England coast, Great Lakes fisheries receive more aid in this respect other locality. The governments of Canada, Norway, nd and Germany are also aiding the industry by the ans.

Commerce.—Foreign commerce in fish is not important ntries having the greatest industry. The United States t Britain consume about as many fish as they catch, fish coming into the United States to replace the sal- sardines exported. The United Kingdom exports

herring to Germany and Russia and imports American sal and French sardines in their stead. Labrador, Newfoundl Nova Scotia and Norway, lands of small population, expor greater part of the fish they catch, chiefly cod, with he second in importance. The great fish-importing countrie Italy, Spain and Portugal, where the Catholic church lays ce

FIG. 112.—The codfish, dry as a bone and hard as wood is admirably for the tropic market. A Porto Rico grocery. (Photo by Miss Helen I

restrictions upon the use of meat and the poverty of the m of the people limits them to a food that is cheaper than n The Latin-American countries and Brazil are also impor fish importers for the same reasons that exist in south Eu and the added one that in such hot climates fresh meat and f fish spoil very quickly while the dried cod, resembling a p of wood in hardness, appearance and durability keeps indefin even in hot climates. The dried cod or stock fish is, in coml

th corn bread or corn-meal mush, a staple article of diet Venice and Valparaiso, Lisbon and Yucatan.

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CHAPTER X

THE FUNDAMENTALS OF MANUFACTURE

The manufacturing industries result from a combination of conditions largely geographic in their origin and covered by the terms raw material, power, labor, and capital. The ease of financial and commercial transfer make capital so mobile that it can go wherever the other conditions demand it, but the location of raw materials, power, and labor is more fixed because of factors most of which are geographic.

The discussion of particular manufacturing industries should follow the presentation of some elements common to all manufacturing industries. The first of these is the human element, labor, and especially the relative abundance of labor and natural resources, a relationship exercising strong control over manufacturing.

1. RELATION OF LAND AND POPULATION TO MANUFACTURE

Cheap Land Opposes Manufacturing.—Where the population is scanty there is much land for every inhabitant, but where the population is dense there is little land for each individual. We all get our living directly or indirectly from the land. Land is, therefore, man's great opportunity, and where there is little of it per person, there is less opportunity to work; therefore, other things being equal, less return for labor, lower wages, and a necessarily lower standard of life. This is usually the most important fact in explaining the industrial history and industrial condition of a nation.

Manufacturing is chiefly carried on by people who work for others, but in America, from the date of earliest settlement to the present, there has been, because of our scanty population and abundant land (cheap land), much greater opportunity to work for one's self and less necessity to work for others than there has been in Europe.

Land Makes Industrial Problems and also Social **s.**—When the first English settlers established them-
t Jamestown in Virginia, and discovered the profit of growing, enterprising and capable men, seeing the abun-
nd, said to themselves, "Here is a fine chance to grow to-
export to England and make money." The one remaining
was labor. But each of his fellow settlers had the same
nity to take up free land and each preferred to work for
rather than to work for his neighbor. If newcomers were
from England they too could work for themselves, and
ry energetic man wanted many laborers and could get
one. Out of this labor scarcity, slavery arose, whereby
ishman could control his labor. Similar situations produce
t similar problems wherever they arise. At the present
Queensland, the northern state of Australia, there is a
ent of country where it is too hot for white laborers to
the fields and there are few colored men there. There-
r is as scarce as it was in the Virginia Colony. Similarly
e men who own the lands could superintend large num-
East Indian, Polynesian, or Chinese laborers if they
them. But this would result in Queensland becoming
y an African or Chinese or Polynesian community, with
all percentage of white people. This the other Austra-
iot wish, and, therefore, they will not permit the Queens-
o import a single coolie, although the population is less
person per square mile. The North and South problem
lso a bitter one, as it was in America in 1861 when the
nted slaves and the North did not.

th Africa the great gold mines of Johannesburg and the
mines of Kimberly require large amounts of labor in a
where nine-tenths of the native population are Kaffirs.
tives are too lazy and too few to do the work regularly,
hite men who make a small minority of the total popu-
also too few. The difficulty has been met by recent
ons of large numbers of Chinese workmen. These
re brought by the mining companies at their own ex-
ler government supervision, and they will be deported
piration of their terms of service, because the British

government does not want an Asiatic population permanently in the colonies.

Cheap Land Checked Manufacturing in American Colonies.—All through the eighteenth century and down to the year 1815, while manufactures were developing in England and manufacturing towns were arising, the young man of America could choose between manufacturing or taking a pair of oxen, a wagon and a few implements and going into the forests of western Massachusetts, New York, Pennsylvania, Virginia, or across the Alleghenies. Here by felling trees, building a log house and clearing a field, he could make a farm. The forest was to be had for the taking, and the young men built frontier settlements rather than go to factories and cities.

The Free Land of the Nineteenth Century.—With the means of transportation then in use, our resources were relatively used up by 1810. Good farming depended upon good transportation and good transportation in the United States depended on natural waterways. Since farm products could only be shipped from near the banks of navigable streams such desirable land was comparatively limited in amount, and very valuable and profitable during the period of high-priced grain produced by the European import during the Napoleonic Wars. The cessation of these wars lessened the demand for American grain and meat. This lowered the profits of farming, the value of farms, the amount of employment, and the rate of wages, which became lower in the eastern United States than they have ever been since. The low wages were produced by the removal of the European market, but they quickly vanished with the coming of the steamboat and the railroad, which placed new resources within the reach of the people along the Atlantic seaboard. The American people who had been clustered along the seaboard and navigable rivers suddenly found themselves able to take possession of the whole continent, and the vast flat prairies of the Mississippi Valley at once became available for settlement. For decades the land was given away by the government to the homesteaders and three generations of Americans triumphantly and truthfully said that "Uncle Sam has a farm for every one of us." From 1816 to 1890 people went from the east to the new west by tens of thousands each year. The records of this population

nt exceed anything that has previously occurred in the of the world. The population of Indiana went from in 1820 to 476,000 in 1840, to 851,000 in 1850, to 1,711,- 1860. Illinois went from 53,000 (1820) to 155,000 (1830), 00 (1840) to 846,000 (1850), to 1,704,000 (1860) and to 0 (1870). The tide of emigration crossed the upper ppi about the middle of the century and the population increased from 192,000 to 674,000 in the decade 1850 The population wave reached Kansas the next decade opulation of 107,000 in 1860 reached 364,000 (1870), (1880), 1,428,000 (1890), and then the increase suddenly 1,470,000 (1900). As our facility in land conquest d the filling of states became more sudden. Nebraska n 122,000 (1870) to 452,000 (1880) and 1,062,000 (1890), the next ten years it remained practically stationary the waves of emigration had rolled on to a newer empty and Oklahoma, for example, newly opened to settlement, l from 258,000 to 790,000 people. So excellent were rtunities to go west and get fine land for nothing that parts of the east people actually abandoned their farms. of this western emigration the population of Virginia ctically stationary between 1820 and 1840, that of nd New Hampshire actually declined between 1860), while the practically stationary figures for Vermont (1850), 315,000 (1860), 330,000 (1870), 332,200 (1880), (1890), 343,000 (1900), 355,000 (1910), are typical of s happened in many agricultural districts throughout in the same period.

n farm lands, often as productive as ever, declined in lue because of the competition of the western land, and who wished to farm could begin easily either east or wing to the influence of these forces it is plain factory that succeeded in getting workmen had to pay es to make them stay, and for that reason American came high and remain high. Immigrants came from ften by hundreds of thousands a year and although they New York and other eastern ports many of them went est where land was free and wages high. Thus the , the Swedes, the Norwegians and the Danes settled

county after county in the states of Wisconsin, Minnesota, and the Dakotas.

Since 1895 the irrigation settlements in the region beyond the 100th meridian have kept before the American people the opportunity to go west and since 1900 there has been an enormous opening up of Canada, where new railroads have been built across the open level plains and where, in the attempt to attract

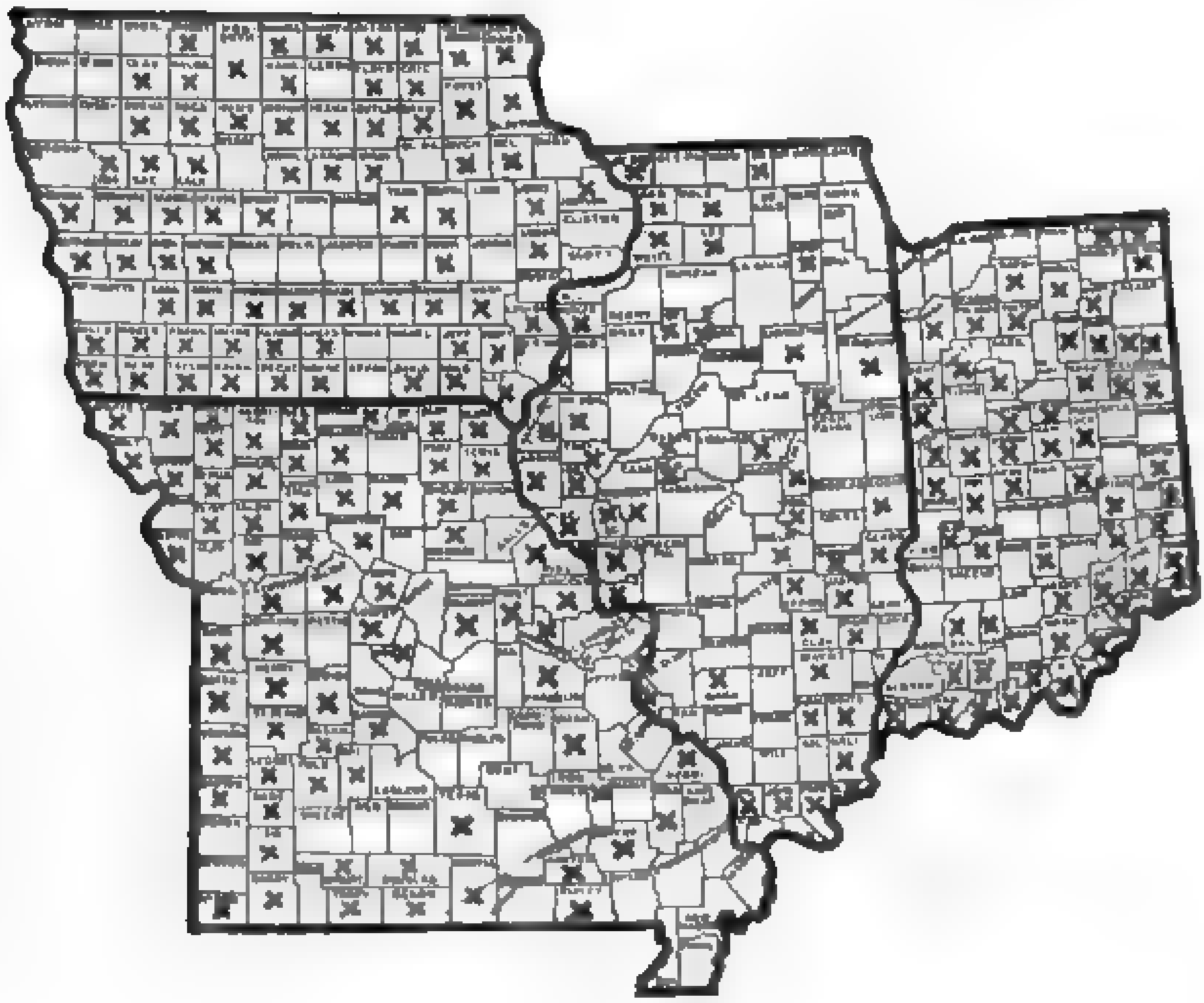


FIG. 113.—Map showing, by black cross, the counties in four corn-belt states that lost population between 1900 and 1910.

settlers, the Canadian government has advertised in Europe and even in the United States the fact that it was giving good land away. History has quickly repeated itself. The Mississippi Valley that was filling so rapidly in 1850 has for a time begun to empty itself into other frontiers. So rapid has been the emigration to Canada that the young man of the corn belt has been able to choose between taking up a free farm in Canada or working for high wages in Iowa. So many went to Canada

ı 1900 and 1910, that the population of the splendid, tate of Iowa declined as it also did in other parts of the lt.[1] During the decade laborers were very scarce in the lt, and crops were sometimes ruined because there were ı to harvest them. Thus farm laborers in the northern ppi Valley near to free land get nearly twice as much ıs those in the valley of the Potomac, who are far from ıd. Because of these high wages, manufacturers have mall progress in the upper Mississippi Valley. Free ı Canada, through their influence on Iowa and other f the United States have actually made higher wages street sweeper or factory worker in New York City, for increase in wages could the laborers be kept in the east.

Resources Have Same Effect as New Land.—The effect dant natural resources and especially of newly discovered y utilized resources upon wages and industry has been illustrated many times in the settlement of this continent. gold was first discovered in California, there was an ıs rush of miners from every state of the Union and ountry of the world to dig up this gold from the sands California rivers. These thousands in a frontier devoid s and food producers had to be fed, and enterprising loaded sailing vessels with flour and provisions and) San Francisco to sell at fabulous prices. But as any ıld go out to the hills and dig for gold, the rate of wages $10 or $15 per day. This was too strong a temptation sailors on the flour ships and they like the soldiers of the States garrison at San Francisco regularly deserted one time there were 100 idle ships lying in San Francisco ause the crews had been tempted away by the higher of working for themselves.

ıpe Nome, Alaska, on the shore of the Arctic Sea, report discovery a few years ago brought a rush of thousands vho when they got there strove for the chance to work for y in the few claims that made up the one gold-yielding Suddenly it was discovered that the sands of the seashore l of gold where each man could wash out $10 worth per

carloads of emigrant goods left one Iowa town in one day in March,

day, and that sum promptly became the rate of wages in all the settlement.

The opposite influence has been lately shown in southern California, whither thousands of people have gone from the east to benefit their health in the gentle climate of the south Pacific coast with its warm and even tempered winters and dry summers. The sudden influx of persons attracted by health rather than resources has caused an overcrowding of many occupations and the compensation has, therefore, become surprisingly low in comparison with the general level of wages in the western country.

The Ease of Living in a Sparsely Peopled Country.—Where population is scarce and the climate favors vegetation, many things grow naturally and are to be had for the taking—free goods. These conditions prevail to a greater or less extent throughout many parts of the United States, but especially south of Pennsylvania and the Ohio and Missouri Rivers and west to the limit of the eastern forest area. This whole region was originally forest covered, and more than half of it is yet covered by some kind of forest growth. Logs and timber are still abundant for the building of houses and the winter, milder than that of the north, permits a cheap house to suffice. The same climatic conditions make less demand for fuel and this the abundant woods still furnish in most rural communities.

While natural conditions, therefore, make houses and fuel cheap, custom permits cheap clothing. A large part of the expenditure of city people for clothes is for style rather than for protection, and the inexpensive cotton suit is about as durable as a woolen suit costing several times as much.

Free Food in Southern States and Its Influence on Manufacture.—It is in the matter of foods that the free goods are most abundant and most helpful in cheap living. From the Rio Grande to the Delaware Bay the first bright days of spring bring a run of fish upward from the sea in thousands of creeks and rivers, and in these regions a family can eat fish as surely by sitting on the stream bank and catching them as can the family that sends to a city market and pays money for them. The herring which can at this season be caught in nets by the millions is sold so cheaply that $5 will buy enough to fill a barrel and supply a family with salt fish for the rest of the year. Before the frosts

inach and lettuce of the city market are duplicated
ring greens which are to be had for the cutting
e fields of the southland. In many parts of the
permits every man to pasture one cow along the

assard cherry tree on campus of Swarthmore College. This
y productive, grows wild in much of the east and south. (Photo
.)

d in other districts pasture for a cow can be had at
2 per month. This family cow, giving from 4 to 12
lk per day, is a cheaper source of supply than the
, charging from six to fifteen cents per quart. In

May and June, wild strawberries are to be had for the picking, as are also the black heart and red heart cherries. These cherry trees grow naturally along the fences and open woods on thousands of roomy farms from Pennsylvania southward, yields of 10 bushels per tree are not uncommon, and the fruit is often wasted because there is no one to use it. After the strawberries and cherries come raspberries and the raspberry season merges into the blackberry season. These two productive briars are regarded as weeds over a territory covering a million square miles in the United States and in most of this region it is common custom for anyone to pick the wild berries wherever they may be found away from the immediate vicinity of a farm house. The blackberry season merges into that of the huckleberry which grows in such abundance in swamps and on mountain sides that they have no sale value whatever until they are picked. After huckleberries come peaches, which grow wild like the cherries along the fence rows in some localities. In autumn comes the persimmon, sweetened by freezing, to hang upon the trees all winter waiting to be eaten. Throughout the lowlands and upon the moist hillsides the black walnut, which is nearly as nutritious as the high-priced English walnut (Persian walnut) is so common that it often lies ungathered on the ground. Before the first frost the chestnut burrs are opened and this sweet nut is not only an important food supply, but it also becomes a money crop of no mean importance and the people roam at will through the woods picking them up for shipment to all the great cities of the northern and central part of the country.

The generosities of nature do not end here. The natural meat supply does not stop with fish. In late August and September the young squirrels are full grown and a good hunter can at times get five or ten in a morning. With frost the opossum is fat and colored men in the south sometimes report the catching of sixty opossums in a single season, thus getting a meat supply which was quite as abundant as could have been bought with the wages earned by arduously working on a trolley track on a noisy street. Moreover, opossum hunting is generally considered more fun. With the falling leaves the oak trees shower down their acorns, the natural food of the hog. Often allowed to run at large in

rests, by December these hogs are fat enough to slaughter year's supply of ham and bacon.

ddition to these free offerings of nature there is a garden ost every house in the country districts and small towns of art of the United States where, if a man desires, tobacco grown, while the sweet potato and a few hills of peanuts his needs in these directions and the "roasting ear," the ripened ear of corn, is a great standby of summer diet. working man in this region has two alternatives. He may egularly, get wages and buy food, or he may work occa-y at the spasmodic labor of the farm and get an equal t of food by going hunting, fishing or berrying—facts of nd influence in checking the development of manufacture.

Exacting Demands of Manufacturing.—Manufactured are produced in a factory that should start Monday morn-the blow of the whistle and work on a schedule until Satur-ernoon. This is an exacting demand upon labor. Through-sparsely peopled district, with the abundant free goods mentioned, most of the laboring population think they are well off if they occasionally stop work and go fishing or g or hunting, and they go. If they want to go to farming, cheap in comparison to the prices in the North Central or Europe.

e are some counties in the tide water region of the Atlantic here almost the entire laboring population is negro and ugust comes most of the crops have been cultivated, the of corn is over, wages are in hand, and roasting ears, produce and blackberries are to be had, and it is the un-custom that nobody works in August. These conditions explain the absence of large manufacture in these terri-hich are the superiors of busy New England in the manu-g resources of raw materials, power, and natural ease of t.

e colder north nature demands more of man. On the prairies of the Mississippi Valley, there is no free house , no free fuel, the fertile level prairie is all cultivated, the fence corner crops of fruits and berries are not so t. While the returns of industry are probably greater tations of free goods are distinctly less and manufactures

are therefore a greater dependence of the people in the north central and northeastern states, where man must depend more upon his own efforts than is necessary in the south. This is one of the reasons why manufacture has developed more in northern districts.

The European Labor Supply.—The chief difference between the life of the people in America and in Europe is explained by the factors already mentioned in this chapter. In Europe the result of density of population is clearly brought out. While

Fig. 115.—In densely peopled Saxony the peasant woman and the dog are draft animals. Factory labor is abundant.

the average population of the United States is less than 50 per square mile, that of Germany is 290; in Holland it is 454; and in Belgium it is 645, or more than one person to each acre. This denser population makes great demands for food, which in turn makes necessary the careful cultivation of land and the consequent high yields give the land a high price, often several hundred dollars an acre. It often costs as much to rent a field for a single year as it does to buy land in the southern or eastern part of the United States. Over large parts of the territory there are no fence rows with berry bushes, fruit and nut trees because there are no

ı. All the land is tilled, and one man's grain field touches ighbor's as do two connecting lawns that have no fence en. The roadsides are often lined with fruit trees, but ıre not the free gifts of nature to be taken by any one in ighborhood, but a crop grown by the farmer or even by al government and sold like any other crop. It is a region le land (per man). He who eats the product of the land either produce it with much labor or buy it. Food prices gh, and wages are low. Under these conditions people vork, and work regularly, and a great difficulty is to get ce to labor. Thus the factories can get laborers and north- ı Europe with its dense population is a veritable hive of acturing industries.

emigration of many million people from the crowded of Europe to the cheap lands of America, Argentine lic, South Africa, and Australia has to some extent raised an wages in the same way that higher wages resulted from ilar emigration of people from the eastern to the western

Industry of the Chinamen.—In the more densely peopled these relations of mere resources and wages are still more nced. China proper, which does not differ greatly in size urces from that part of the United States east of the Missis- ver, has five or six times as many people. For many gen- their numbers have been so great that they could support ves only by diligent labor, in agriculture and in household es. As a result the work habit is so thoroughly estab- mong them that they are among the most industrious of the world, the best of laborers, and, by their thrift rgy and ability to live on little, so able to crowd out the ces in economic competition that for mere self protection excluded by all white nations to whose lands they have ed to emigrate in large numbers.

2. IRON AND STEEL

at is the dependence of our modern civilization on iron abundance of this metal is generally considered an essen- of a nation's wealth. The present is often spoken of as f steel and steel is merely a kind of iron. Iron and steel

Short Life of Mining Industries.—The iron industry is typical of the mining industries, which are, in contrast to agriculture, always temporary. At best, the digging of a mineral is the removal of the accumulation of ages, which when once removed is gone forever. The Germans call it "The Robber Industry." The life of a mining town is therefore temporary and uncertain. Such towns rise and fall, or change the source of their support, while an agricultural community may live on undisturbed, tilling the same fields for three or four thousand years, as in parts of China, and the field may even be the better for it. The iron industry especially has roamed from place to place as changed conditions in manufacture, industry, and commerce have made it profitable or unprofitable. It does not depend on ore alone. There must be fuel, labor, and markets, a combination of factors. A change in any one factor may upset this industry as it does so many other industries.

History of Iron Making.—Iron is extracted from the ores by burning off the impurities, the chief of which is oxygen. No ordinary fire will make sufficient heat, but prehistoric man learned how to make a super-heated fire probably by the means still in use very recently in so many parts of the world by peoples with primitive industry, as in interior China or central Africa. A hearth or forge was made with an artificial draught worked by bellows driven by hand or foot or occasionally by the force of a prevailing wind focussed through a funnel so that the fire got hot enough to reduce the iron to a sticky mass in the bottom of the fire. This was purified by pounding and it made a metal the *quality* of which has never been excelled. These forges were pretty much alike the world over, and commonly bear the name of Catalan Forge, after the Spanish province of Catalonia. The universal fuel for this forge was wood charcoal. Only the best ores could be used and this industry was naturally dependent upon the combination of ore and forest in the same place. This type of apparatus made the world's iron for at least 2,000 years and probably much longer. While good, it was costly, so costly that mediæval builders climbed up and dug out of the solid rock of the Coliseum at Rome, the links of iron with which the Romans had fastened the stones together. The refuse of

ival and Roman iron makers was long ago used up as ore by later British manufacturers.

vard the end of the mediæval period the forges were made and the draught was made stronger, until finally it was the name of blast and we had the blast furnace, first used gium about 1340. This new device melted the iron into id which absorbed impurities and was poorer iron than the xpensive product of the old forges, but it could be run off oulds for cooling in convenient forms. This "cast iron" be purified before it has qualities other than weight and strength. The blast furnace, like many modern inven- sacrifices quality for quantity and cheapness.

fuel of the early blast furnace, like that of the forge it suc- l, was charcoal, and the iron industry in England came into ate in Queen Elizabeth's time and was subjected to restric- gislation because it devoured so much wood that, to keep going, it followed the vanishing forests of England from to place. In the eighteenth century it seemed that the h iron industry was doomed because of the limitation of el. There was large iron import from the pine forest ;s of Germany and imports from the American colonies the Atlantic had begun and the basis for a great trade sible between the forested colonies with abundant char- aterial and the bare mother country. But this trade was ed and even reversed by a single invention, when in 1740 glishman named Darby learned how to make iron by use in the form of coke. This gave the English iron industry lease of life and it prospered greatly through the period establishment of the factory system and the early nine- century when no other country had industrial access to sources of fuel, ore, and labor.

ie middle of the nineteenth century, the railroad, the iip, the modern factory with its great use of machinery, a rapid increase in the use of iron, and Britain with her sources of coal and iron ore lying side by side became the iron-making country in the world. The location of the d coal fields on the west coast of England, southwest of Scotland and of Wales and the east coast of England sy access to the sea for export, and later, when the ore

supplies ran low in England, it was easy for the English iron industry to turn to a supply of imported ore from the mountains near the north coasts of Spain and from northern Sweden, where in recent years large developments of the iron industry have taken place.

Iron Making in America.—The United States is the twentieth-century leader in iron making, as was England during the nineteenth century. This leadership has come as the result of a number of rapid transformations of the industry in this country. In George Washington's time the little forges or small blast

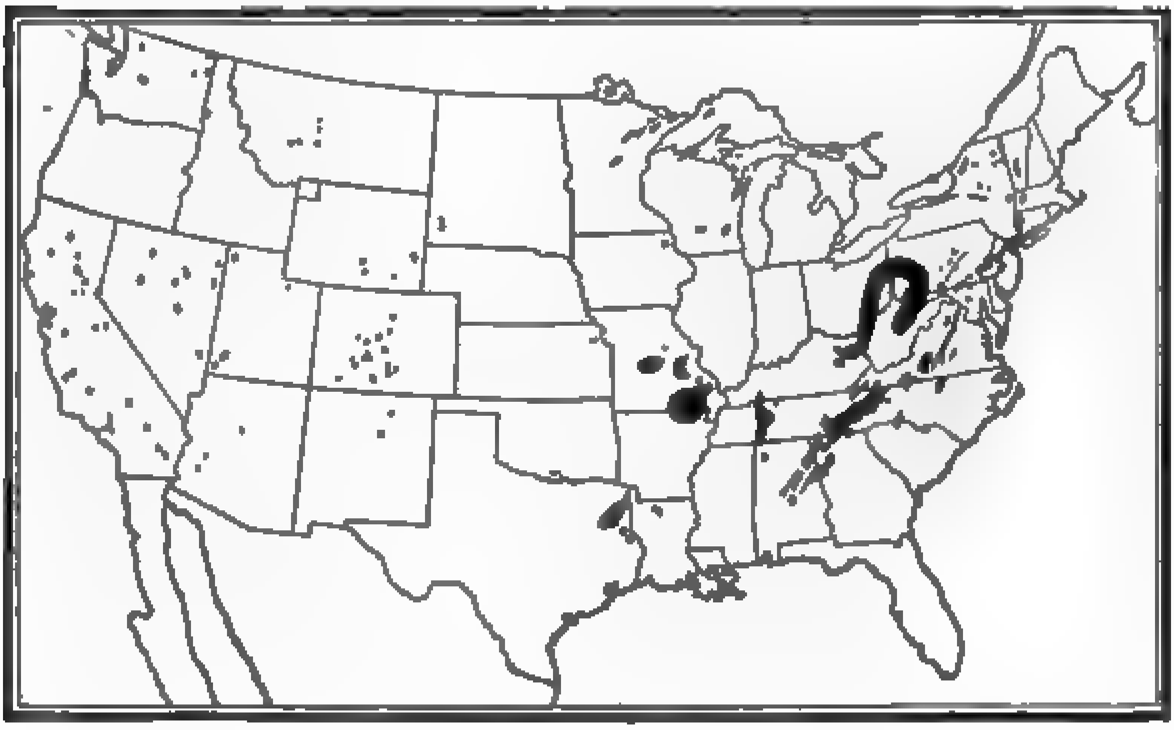
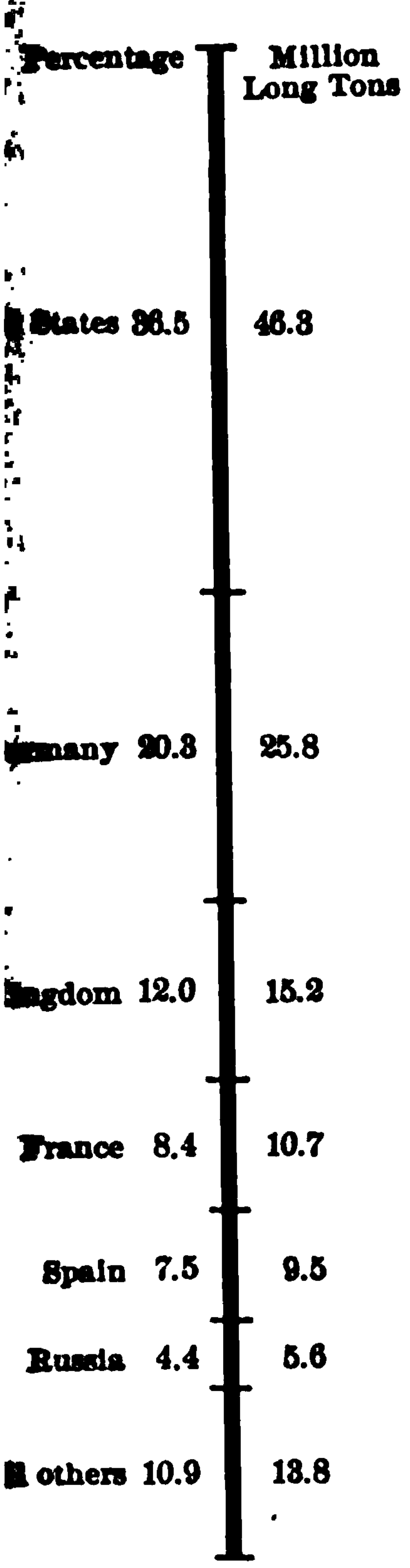


FIG. 117.—Map showing general distribution of iron ore in the United States. (From W. S. Tower.)

furnaces with a draft forced by a water wheel were scattered from New England to Georgia and from the sea coast to Appalachian valleys in what now seem to be remote and isolated locations. Iron was made wherever the local blacksmiths needed iron, and a good ore bank, water fall, and the American forest, almost universal in the East, furnished the necessary raw materials. While England was at that time using coke, American coal lay far back in the forests of Pennsylvania and West Virginia, remote from all the paths of easy commerce.

Fortunately for the American iron industry, the first coal field to be developed was the anthracite, which, by its purity and

erved well for smelting purposes without being made Here was a factor that gave one region a heavy over all others and after 1840 we had a rapid concen- the iron industry in the Schuylkill Valley and other jacent to the anthracite coal mines of eastern Penn-



World's iron-ore produc- -year average, 1908–10.

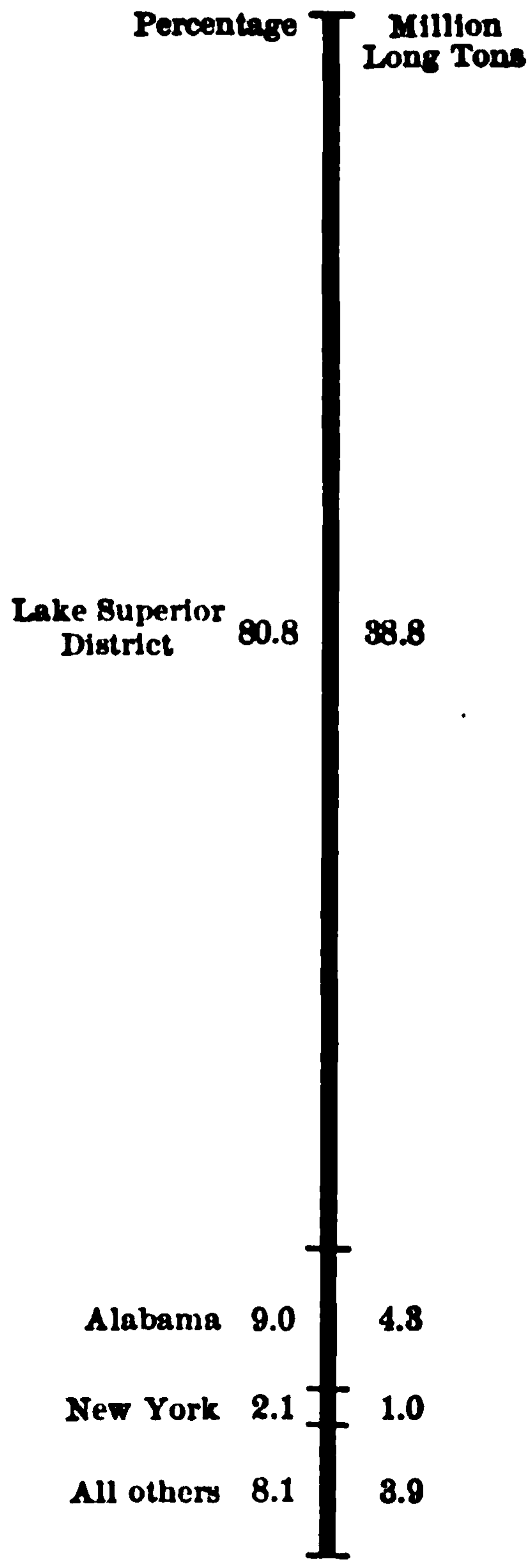


FIG. 119.—Iron-ore production of the United States, three-year average, 1908–10.

The charcoal forges and charcoal furnaces gradually of use, and most of them have long been picturesque vine-covered ruins in localities that show plainly the passed prosperity. The forge was a part of an indus- rather than an industry. The farmers of the commu-

nity worked at charcoal burning and ore digging when not busy with their crops and the much hauling of the materials gave employment for farm teams when there was nothing else for them to do. The old forges survived longest in locations remote from the places of superior manufacture and in the isolated mountains of western North Carolina and other parts of the southern Appalachians, where some of them were running for purely local supply as late as the year 1900.

Fig. 120.—Grab buckets of Hewlett automatic ore unloader lifting cargo from the hold of one of the Great Lake boats with its continuously open decks. (Wellman Seaver Morgan Co., Cleveland.)

Pittsburg and the Upper Ohio Valley.—The supremacy of the eastern iron districts was short because the building of railroads through the soft coal regions of western Pennsylvania caused the introduction there of coke making, for which the coals of the Connellsville Basin were particularly adapted. The iron industry promptly rose in that region and in the year 1875, the 900,000 tons of coke-made iron in that region exceeded in quan-

that made with the much more expensive anthracite coal. enormous development of railroad building after the Civil made rapid increase in the demand for iron. Pittsburg, good local ores and abundant coke and coal, was a natural for the assembling of the raw materials. Being at the of the Ohio Valley, and the junction of the navigable streams, as an excellent point for the shipment of both raw and ied products and rose rapidly to be the center, first of the rican and then of the world's iron industry. The importa- of richer iron ore from the Lake Superior district began in but in America, as in England, the old English adage true in most cases that the ore goes to the fuel, so that urg held the leadership, although the source of ore supply nly shifted from the valleys of Appalachia to the pine along the shores of Lake Superior. To bring these ores the distant mine there have been evolved wonderful nisms which load, unload, and carry the ore with aston- cheapness.

nges in the Location of the Industry.—Fuel has been the no that moved the iron industry, as from England to the s of Germany for charcoal, and back to England for coke; the forests of New Jersey, Carolina and Maryland to the acite of the Schuylkill Valley and thence to the upper basin for Connellsville coke. The efficient railroad now s this coke to very considerable distances, but a more t decentralizing force is now in operation. It is the new ses of coke making which enables the iron maker to get coke in many coal fields, thus destroying the regional oly that existed when all coke was made in the old bee ven (see section on coal) and that from Connellsville coal ithout a rival. The making of iron is again spreading in se to this widened fuel supply.

re is, at present, a tendency for the making of iron and rom Lake Superior ores to shift slowly from Pittsburg to Shore points, such as Buffalo, Cleveland, Chicago and The whole of the triangular region between Pittsburg, o, and Buffalo is dotted with towns having some of the idustries, such as bridge plants, nail mills, wire fence steel car plants, and other varieties of iron work. The

tendency of the industry to shift to the Lake Shore points is due to the economy that results from having the blast furnace located beside the ore dock where the lake steamer unloads, as they may at any point on the shores of the lakes from Buffalo to Chicago. Manufacture under such conditions requires one less handling of the ore than is necessary at an inland point like Pittsburg, or Youngstown (Ohio). This economy has been instrumental in causing the removal of the Lackawanna Steel Company's main plant from Scranton, Pa., to Buffalo, and it was also an important factor in causing the United States Steel Corporation to locate at Gary, Ind., on the lake shore near Chicago, its latest plant which is, when finished, to be the largest and most complete in the world.

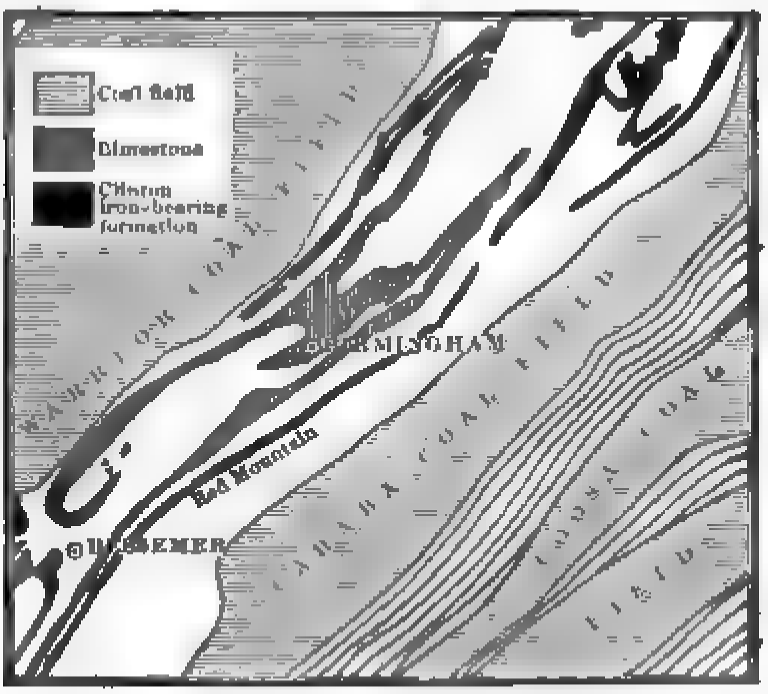
Several minor producing districts exist in the United States. In northern Alabama, Birmingham, named from the iron city of England, possesses iron-making facilities that are probably unrivalled anywhere in the world. No other locality has such a natural assemblage of raw materials. On one side of the valley is an open ledge of iron ore, on the other side is the limestone necessary for fluxing the furnaces, while coal mines are but a few miles away. The iron industry is here of growing importance and costs of production are lower than at any other place in America.

At the head of Lake Superior other iron plants are arising, using the local ores and coal brought from Pennsylvania by the vessels that have carried ore eastward to the Pennsylvania furnaces. This is a case where the fuel goes to the ore, in violation of the old adage that "the ore goes to the fuel." The reason is to be found in the location of the market, which is in the region west of Duluth. Under such circumstances it is cheaper to make the iron at Duluth with Pennsylvania coal than it is to carry the ore down the lakes to the coal and then carry the iron back again.

The same reasoning explains the carrying of western Pennsylvania coke to the iron ore beds and the iron plants east of the Alleghanies, as those of Lake Champlain, northern New Jersey, Baltimore, and eastern Pennsylvania.

Although many of the furnaces east of the Alleghanies have ceased to be used, there is still some iron made in Pottstown and

m, Lebanon, and Steelton, Pa. The eastern Penn- plants are mixing local ores with some ore from Lake and some imported from Cuba, Spain, Newfoundland, r foreign countries. The recent importation of ores a revival of eastern iron making. Despite our great iron ore there is an advantage in iron quality resulting xing ores. Our chief import is from the district of Cuba, whence several ships a week sail for Baltimore



1.—Birmingham District, Alabama, showing a relation of iron ore, limestone which permits the cheapest iron manufacture in the world, per cent. of a cent per pound. (Map after Brigham.)

ladelphia, while lesser quantities are brought from New- nd, from Sweden, from Spain, from the Island of Elba Mediterranean Sea, and scattering cargoes from the coasts Black Sea, South Africa, and South America. Americans ecently purchased ore lands in Chile.

location of the plants within 100 miles of the Atlantic d gives them an advantage over Pittsburg and Lake oints for the supply of the eastern markets and the export The increase of their prosperity is indicated by the g in Philadelphia by one railroad of a new ore dock with ity of 1 million tons per year.

olorado, which has local coal and ore, is another new tter, and, being a thousand miles from any other iron-

producing district, is of great importance in the Rocky Mountain region, but the output is only about 1 per cent of the total product of the country.

The Pacific Coast, with its scarcity of fuel, high wages, and convenient access to water-borne cargoes from eastern plants, has developed only a very small iron-smelting industry. Its shipyards and foundries import most of their material from the eastern States and from Europe, a process that will be made easier by the opening of the Panama Canal.

Steel Making.—Steel is merely a kind of iron which is hardened by an admixture of definite amounts of alloys, mostly carbon. There are three processes of making it. An old and excellent process called cementation begins by taking cast iron, putting it into a puddling furnace, which is a sort of basin with flames beating over it. The puddler stirs the molten iron in the basin with a rake while the flames burn the carbon out of the iron. When the coarse carbon of the casting is nearly all burned out, the iron, then called wrought iron, is very tough, malleable, and ductile. In the cementation process the wrought iron, cut into one-pound chunks, is packed in air-tight boxes with charcoal (carbon) and the whole box kept red hot for a few days, during which the carbon in right amounts and quality is slowly absorbed by the iron. This ancient method has not been improved upon when the object is the best of high quality steel, such as is needed for cutlery, firearms, and instruments of precision.

But the railway and the steamship require a cheaper metal; the great development of world commerce could not come until after the invention by an Englishman, Sir Henry Bessemer, of the so-called Bessemer process, by which 20 tons of steel are made in a few minutes by putting molten iron in a large retort through which a current of air is blown violently. The oxygen of the air unites with the carbon in the iron and burns it out. The product is then virtually wrought iron, which is changed to steel by the addition of the proper amount of carbon in the form of high carbon iron called "spiegel-eisen." The quick method of making Bessemer steel is cheap. The cost is but a small fraction of that of making cementation steel, and it has been of great service for 50 years in making steel rails for railway tracks, and beams for bridges, buildings, and elevated railways.

the great weight of the present day locomotive requires r rail than the Bessemer, which breaks without warning. ew demand is met by a newer, slightly more expensive called open-hearth steel. This is made by putting molten a basin over which flames from a gas-fed fire beat for 8 or rs until the carbon content is reduced to just the right t, which can be determined by testing. This stronger ore uniform open-hearth steel is used for boiler plates, lates, and the best steel rails now used, and is rapidly cing Bessemer steel as the chart clearly shows.

U. S. STEEL OUTPUT, MILLION TONS

	Bessemer	Open Hearth
1900.........	6.6	3.3
1901.........	8.7	4.6
1902.........	9.1	5.6
1903.........	8.5	5.8
1904.........	7.8	5.9
1905.........	10.9	8.9
1906.........	12.2	10.9
1907.........	11.6	11.5
1908.........	6.1	7.8
1909.........	9.3	14.4
1910.........	9.4	16.5

l is really an alloy of iron, a mixture of iron and carbon. us special steels, made by alloying iron with other sub- s than carbon, are produced in small quantity. Their ance is not measured by their quantity but by their high ess for special purposes, such as the very hard nickel r armor plate for battle ships and industrial uses where hardness is important. Chrome steel and tungsten steel he quality of holding their cutting power better than steel does in a metal working lathe. By this means a few d tons of tool steel have multiplied several fold the effi- of thousands of machines and machinists. Vanadium far superior to carbon steel in its lessened tendency to

break without warning—a quality of especial value in automobiles and other vehicles where the continuous jarring of motion causes crystallization and fracture without warning.

Iron as a World Industry.—Extensive iron making is an industry of countries advanced in manufacturing. It requires excellent transportation facilities, much capital for the enormous plants, large number of laborers, and the large market which only many people can give. It is very distinctly *not* a frontier industry, and this is just as true in the new states of the United States as it is in Australasia or South America. As a result, six countries dominate the iron making of the world, and three of these are of distinctly minor importance. The United States, Great Britain, and Germany make four-fifths of the world's supply, Belgium, France, and Russia are the next group and after they have been named, there is little left of the world's iron industry. South America, Africa, Asia, Australia, the East Indies, all the islands of the sea, and all the countries of the Mediterranean do not together make as much iron as a single Pittsburg company.

There are a few furnaces in Mexico, but, owing to lack of fuel, Central America and South America are devoid of iron making save for some charcoal furnaces at Corral, Chile, with a capacity of 200 tons per day. (Single furnaces at Pittsburg make 600 tons per day.) All of Africa is without iron making, as is practically all Asia, except a small quantity in China and Japan. The lack of an iron industry in these countries is no index whatever of the lack of an ore supply, for most of the countries mentioned have large quantities of it. Australia, with both coal and ore and ability to borrow English capital, has virtually failed through the lack of the necessary labor supply.

The German Iron Industry.—Germany is the second iron manufacturing country of the world, having passed England in output about the end of the nineteenth century, but the German iron district is economically part of a district which extends through northern France, Belgium, and the lower Rhine Valley, where local ores, coal, and the dense population give the necessary conditions for modern iron making. The navigable Rhine, with cheap transportation by barge, makes possible the import of Swedish and Spanish ores through Rotterdam, Amsterdam and via canal from Antwerp, and the export through these same

whose steamship lines take the finished products at cheap o all the world. The town of Essen on the navigable Ruhr, reaching the Rhine below Cologne, is the center of the world- s German iron industry owned by the Krupps. Some s made on the coal fields of central and eastern Germany, e Rhine valley district (Westphalia) is to Germany what iicago-Pittsburg-Buffalo triangle is to the United States. halia with its Rhine boat connection with the world ig lines has a location from which export is easier than Pittsburg.

nany has not exceeded Great Britain as an iron maker e of superior advantages. They are inferior, but both ment and science have fostered the industry. By her tive tariff she has restricted the home market to the German es and the population exceeds that of the United Kingdom ird and the demand for iron has been keen. The Germans een late in the development of manufacturing and mining ies and the Empire has for three decades been equipping as England did in an earlier period. A vigorous policy ernment assistance has fostered the export trade and in ar 1910 German steel exports exceeded those of Britain. portance of the foreign trade to British manufacturers is by the fact that in 1910 nearly one-half of the 9 1/2 tons of iron was exported in some form.

r European Iron Production.—Austria is an insignificant aker because her ore and coal fields are separated and the ansport necessary to assemble material of only moderate s is too costly. Her iron industry is located in the is and manufacturing state of Bohemia and the coal in s to the southwest of Vienna.

whole Mediterranean basin is barren alike of coal and iently of iron making until the Azoff basin of south is reached. There the demands of an empire with a ion greater than the United States, and undeveloped ies are causing a rapid increase in iron making, but the ussian production for 1910 was but 2.9 million tons or cent. of that of the United Kingdom (10.3 million tons) per cent. of that of the United States in 1910 (27.3 million

At Bilbao, a Spanish port on the Bay of Biscay, there is arising an iron industry (less than half a million tons) with an explanation similar to that of the Duluth furnaces. Bilbao exports several million tons of iron ore annually to England and the returning ore vessels carry fuel to Bilbao for the operation of furnaces there built by British capital.

Sweden, with a large percentage (52.2) of her area in forest, has had the wood to keep on making charcoal iron which is superior in quality to that of the coke-fed furnace, and is much sought by blacksmiths and machinists in many countries. For example, Sheffield (England) cutlery is made of Swedish iron, and the Swedish production of charcoal iron is now giving rise to the manufacture of high-grade machinery in Sweden.

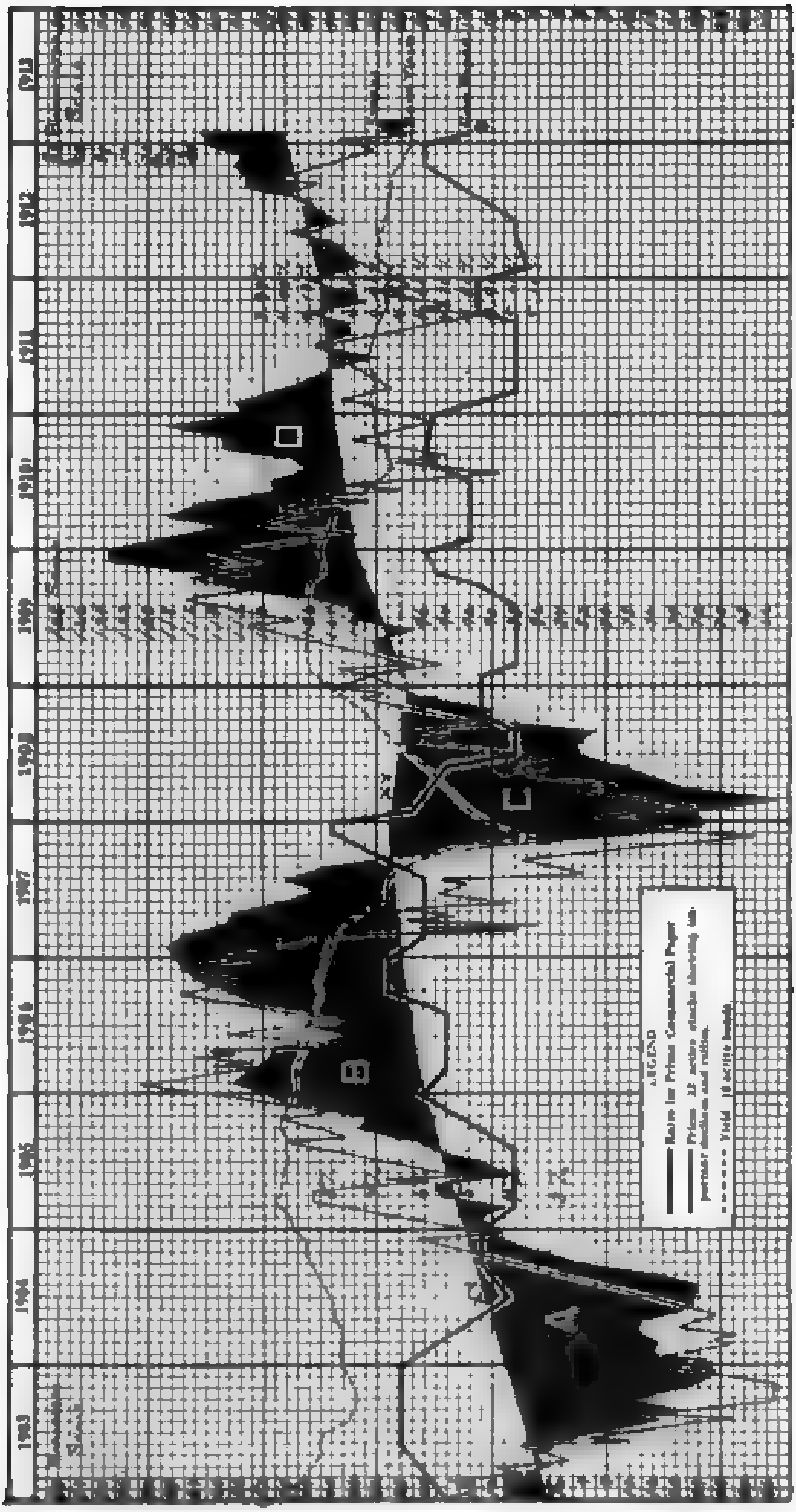
Iron in Japan and China.—Japan, the last of the nations to gain recognition as a world power and to enter diligently among the world's manufacturers, is a country comparatively poor in coal and much poorer in good iron ore. Her first modern shipyards used European iron. It is only within a few years that iron works there have been established, using ore brought down the Yang Tse Kiang River from central China. China is as conspicuous for her iron riches as is Japan for their poverty. In addition to possessing, next to the United States, the most abundant supply of coal in the world, there is much evidence to show that iron ore exists in great quantities and good quality. A little iron has been manufactured in the primitive ways for ages, and now that China is adopting modern methods the possibilities of the future iron industry are a matter of interesting speculation. Both the great raw materials are there and also a labor supply exceeding in amount that of any three western countries. Already in a period of great prosperity and temporary shortage in the American iron market, the product of a modern blast furnace located at Hankow at the junction of the Han and Yang Tse Kiang Rivers has sent its product to the port of New York, where it had to pay a heavy tariff in addition to a freight charge for transportation half way round the world. In 1910 a steel company operating on the Pacific coast of the United States contracted with the Ta Yeh iron mine on the Yangtse to take annually for the next five years 36,000 tons of pig iron and 36,000 tons of iron ore, both to be made into finished products

United States. It is quite possible that there are more gs and readjustments in store for the world's iron industry, here is little question that China possesses the possibility ninance in open markets.

d Commerce in Iron.—While the large production of iron lized in a few districts of eastern America and western e, its commerce is world wide. All peoples who trade use many forms, so that from England, Germany, France and ited States the manufactured products go to every country. uropean countries with their older industries and their r labor produce the more highly manufactured forms s cutlery, tools, instruments, and the finest machinery. the United States, which excels in raw materials and labor-machinery, the heavier products are shipped, such as d rails, bridges, girders and plates. Pittsburg rails and s are to be found upon the railways of Mexico, Man-, on the upper Nile at Khartum, upon the African lakes anda, in Australia, Japan, and in Ecuador. The steel f Europe and America will continue for many decades ip with steel the new countries of the world.

Future of the Iron Industry.—Despite the many shiftings iron industry it has as yet used but a small fraction of the re supply. The amount of ore throughout the world is eat, some of it being of good quality, but much the greater y is of relatively low grade such as we have not as yet mpelled to use. The iron industry, being comparatively has thus far drawn only upon the best ores. The distance age has rarely exceeded 500 miles, except where the ores een so located that they could be water borne nearly way fron the mine to the furnace, as for example, between port of Bilbao in northern Spain and the furnaces of in Furness, on the west coast of England. The Swedish ater borne to England and to the German plants upon ine navigation, while the great American movement of s is made possible only because of the astonishing cheap-carriage by the very large and fast steamboats of the n Great Lakes, which leaves but short distances for the s to carry the great bulk of the ore.

cean steamer now renders such cheap service that the



ıear the coast of distant lands such as Central America, l, South Africa, and Sweden are in terms of freight rate much r to the furnaces of Pittsburg, Glasgow, and Essen than res of Colorado or central Russia. This gives a world y of iron ore and indicates that the increasing American t of Swedish and Spanish ores is not an exception but part world movement. The United States Steel Corporation urchased the famous iron mountain of Durango, Mexico, o contain 300 million tons of iron. American companies ported to be investigating similar deposits in Honduras the idea of building railroads to export the ore. The ian government has started improvements of the port of ia (latitude 20° south) to make possible the export of from million tons of ore per year. The import of Chilean ores itish iron makers is under consideration. (U. S. Con. June 10, 1911; Sep. 4, 1911; Feb. 2, 1911; and Dun's ational Review.) Six thousand miles by steamer and 1,000 by rail is not an unreasonable haul and it is one that will

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2.—**Babson Chart of American Business Conditions.** (Copyright, 1913, by Roger W. Babson.)

arge black areas are formed by combining and plotting the published figures for nine years on New Building, Crops, Clearings, Iron Production, Money, Failures, , etc., in order to give a Composite Plot of actual business conditions, in the United The line XY represents the normal growth of the country's business, the slope nged whenever there is sufficient evidence of a change in the trend of conditions. the economic theory that "action and reaction are equal" when the two factors ıd intensity are multiplied to form an area, the sums of the areas above and below of normal growth XY must, over a sufficiently long period of time, be equal, pro- line XY is properly located and enough subjects are herewith included, with all weighed and combined. Moreover, owing to the law of averages, and certain ical laws, these separate areas tend to be equal *in area*, although not necessarily in 'hus, in our opinion, business should enter a depression which will cause another formed below the line XY when the area D has expanded to approximately the average of areas "A" "B" and "C," it being improbable that business should keep ıe line XY long enough to start a new series of areas. It, however, should be ed that this next period (which will be called "E") may be of an entirely different n anything heretofore witnessed and still contain a similar area. Knowing that tend to be equal, one can always estimate the length of any period by watching : its height, or "rate of flow," which shows how rapidly it is being consumed. solid line represents the average price of stocks, the dotted line the average yield and the heavy black line represents the average interest rate for prime paper. A hese lines shows that the high point of the stock market has come when the pros- s is about one-fifth consumed and the low point has come when the depression out one-fifth consumed, that low money rates and high bond prices have come at beginning of a prosperity area and high money rates and low bond prices at the of a depression area. Owing to the increased study of fundamental conditions s should slowly decrease in size. "E" being smaller than "D." The figures ıder 1909 refer to the light solid line, which shows the average price of the thirty- ı. The figures under 1911 refer to the dotted line and show the average yield of . The figures printed under 1905 refer to prime commercial rates."

make nearly all the earth accessible to one or the other c great iron regions—Orient or North Atlantic.

The electric smelting of iron ore has long been experim with and seems to have passed the experimental stage in Sv at least. Successful operation in 1911 reached a prof stage, making a ton of iron per year horse-power of electr ergy and at Jorpland, Norway, this power costs but $6 a water-power plant. It is calculated that ores of only 4 cent. can be utilized. (U. S. Con. Rep., Jan. 23, 1911, anc 19, 1911

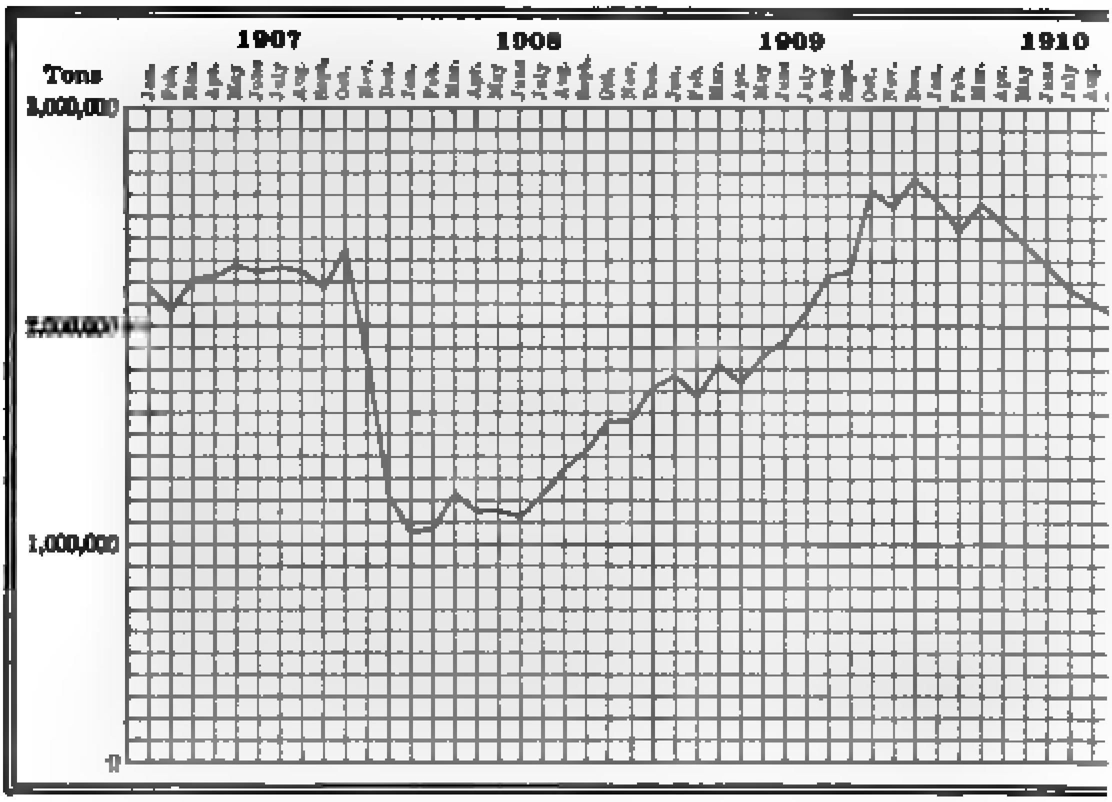


FIG. 123.—Production of pig iron in United States by months, 1907-10. Trade Review.) The iron industry is called the Industrial Baromet

Any idea that the United States has great advantages Europe in the making of iron is scarcely founded upon a examination of the basal facts of industry. The best o Lake Superior ores are richer than those of Europe, bu average quality is already declining and the cost of mini increasing. The carriage by rail to upper Lake port, by ste to lower Lake port, and again by rail to Pittsburg is a labc journey over a distance but little greater than that from Castle to the Swedish ore beds via the Norwegian port of Na and it is greater than the 700 mile open-sea journey from Bi

to Cardiff, and the English iron masters operate their mines with laborers receiving fifty to sixty cents per S. Con. Rep., Oct. 10, 1910).

omparison of distances is not to England's disadvantage hould be noted that the American Great Lakes are closed f the year by ice, while all European ore districts, includ- Great Gellivare deposits of Sweden within the Arctic re able to ship continuously over the open sea. The ful ore-handling equipment of the United States, much in the world, is the means by which we have overcome ps.

any is but little worse off than England and is building ore-carrying roads to the enormous iron deposits of Lorraine.

was never a time when many countries were on such with regard to a supply of iron.

anese.—The mining of manganese ore is (like much g of limestone) an adjunct of the iron industry which f it stood alone, command considerable attention. We ture no metallic manganese, the entire supply being iron manufacture to produce iron of particular grades. ld's production of 1 1/2 million tons is practically all the iron industry, and is supplied chiefly by Russia cent of total), India, and Brazil. About 400,000 tons r year are exported from the Russian Caucasus by way lack Sea ports. Twenty-five freight steamer loads of ame to us from India in 1911, 131,000 tons, 60 per cent pply. Brazil furnishes most of the remainder from the Ouro Preto in the state of Minas Geraes. The American n, chiefly from Virginia, has declined to insignificance ns) because of the competition from India and Brazil.

3. COAL

development of manufactures iron is important, but ssion of some source of mechanical power is a much ent factor in deciding a nation's rôle in manufacturing vilization. We depend upon mechanical power in a unlike the dependence of young children upon their

Our Absolute Dependence on Coal.—If some wizard should, upon the first moment of some incoming year, banish all coal from the world, instant darkness would settle over the streets in most of the world's great cities and their inhabitants would rise the next morning to find their houses cold, nearly all their factory wheels would be motionless, and the starvation that immediately faced them could kill millions of people before another January first had come. England would be the worst sufferer, because coal-driven steamships and railroads bring to that country much of the food and raw materials upon which her people depend for sustenance and industry. There would be no escape from the panic-stricken island because the coal-driven steamships of the world would lie helpless, sailing vessels and oil burners would be grossly inadequate, and to build more vessels would require iron and wood, neither of which could be had without the use of coal. The people of Germany, Holland, and Belgium, New England, and New York City (this city used over 15 million tons of coal in 1909) would be in nearly as bad a plight as those of England. The only possible escape would be through the conversion of coal-burning steamships and locomotives into petroleum-using ones, and even if we had enough petroleum, this change probably could not come fast enough to avert the catastrophe, for world commerce is now coal-driven commerce, and world manufacture is chiefly in the steam-driven factory. Coal is thus back of both factors which have enabled man in the nineteenth and twentieth centuries to separate so widely his home space from his sustenance space.

All the modern nations have at their disposal mechanical power, chiefly coal driven, which far outranks the combined muscular force of all the men and all their beasts and the increase in its use is very rapid (see table, Page 373). If all the coal used in the United States were used to generate power in moderately efficient plants of large size in which 2 pounds of coal generate 1 horse-power for one hour, the resultant energy for 300 working days in the year would be at the rate of about 750 man-power for each living man in the United States. This is on the basis of ten men per engine horse-power, which is actually lower than the facts would be.

Early Use of Power in Holland and England.—Holland with her

l mills was the first extensive user of artificial power. She l wind because she had no waterfalls such as have long been l to some extent in other countries. For the same reason l mills were used to grind the breadstuffs in the early days Rhode Island, Eastern Long Island and on the flat prairies linois. England, already a coal user when the steam engine invented, quickly took from Holland the leadership in er development, and then in manufactures, because she has mous[1] good coal fields near to the sea and near to the iron, h is necessary for the harnessing of power derived from England had, in addition to power, an adequate labor ly, a stable government, and peace. With these advantages nodern factory system quickly originated. It came after mber of mechanical inventions in the latter part of the eenth century made it possible to assemble many workers e building where their machines could be run by a common e. Previously, the English manufacturing had been done nd machines in the cottages of people who lived in populous

POWER CONSUMPTION OF U. S., 1870-1905

r used for manufacturing	Total Horse-power		Horse-power per wage earner		Horse-power used per $1,000 of output	
	1870	1905	1870	1905	1870	1905
	Thousands	Thousands				
ural implements	26	106	1.0	2.2	0.5	1.0
ıd shoes	3	62	0.1	0.4	0.1	2.0
goods	146	1,040	1.1	3.3	0.8	2.3
ıd grist mill products	576	780	9.9	19.9	1.3	1.1
and knit goods	6,500	84	0.4	0.8	0.4	0.6
l steel	170	2,725	2.2	11.2	0.6	3.0
and timber	641	1,500	4.3	3.7	3.1	2.6
ıd pulp	54	1,125	3.0	17.0	1.1	5.9
ls	2	79	0.3	1.0	0.2	0.6
goods	85	164	1.1	2.3	0.5	1.2
goods	8	130	1.6	1.9	0.4	0.8
factories	626	6,850	.....	.....	.....	.....

Power consumption, 300 per cent.
Power rates to population, 100 per cent.
Power rates to wage earner, 164 per cent.
Power rates to $1,000 of product, 137 per cent.

mated to last six centuries at present rate of consumption.

country districts and tilled some land. But coal and steam made easy the establishment of the factory system, and condensed these people into cities usually to their physical injury, changed Britain from an agricultural to a manufacturing country and transferred the center of population and power from the agricultural southeastern plains to the rougher, more mountainous north-northwest and west with their coal and iron. Here people live in towns and get almost all agricultural products by trading, and the many manufacturing cities that have been developed give England a higher proportion of city population than any other country in the world.

The British Coal Fields.—The location of British coal fields favored this early development. The coal is good, although it is all bituminous, and the fields are well distributed, some on the east coast, at Newcastle, some on the west coast, in Cumberland, some in Scotland, near Glasgow, some in Wales, near Cardiff, and some inland near Sheffield and Birmingham and Manchester, making possible a varied development of industry. Each coal field has developed an industrial district. The southern inland coal fields support the great iron and steel manufactories of Sheffield and Birmingham, the northern give power for the cotton mills of Manchester and the other towns of Lancashire and the wool manufactures of Bradford, Leeds and Huddersfield in Yorkshire. The Cumberland field in northwest England, has an iron center at Barrow-in-Furness, and the fields of southwest Scotland make Glasgow a great port and iron center and the Clyde a great ship-building river. The coals of Newcastle near good harbors have for three centuries been carried in ships to London and across the North Sea to continental points, while the neighboring cities of Shields, Middleborough and Sunderland have of late become great ship-building and iron-manufacturing centers. The southwestern fields in Wales have led to a great smelting industry and export of coal, a branch of the foreign trade in which England exceeds all other countries of the world combined. Some of her publicists have urged the stopping of the coal export because she is thereby hastening the day when she will have none for her own use.

British Coal Exports.—The grain ship brings bread for the British people to eat, the refrigerator ship the meat, the lumber

the planks from which they build their houses, the cotton wool ships the fibers with which to clothe themselves and ships yet other materials for their factories. The exports anufactures are much less bulky than these imports, and hips that would otherwise go away empty carry the coal ritain into every sea and to most of the world's coalless . It is from England that the coalless Dutch, Danes, egians, and Portuguese get their supply, while empty steam-outward bound to the Danube and Black Sea ports carry oal burned by the Italians, Greeks, Spaniards, and Arabs the shores of the coal-barren Mediterranean. For the reason British coal goes in hundreds of thousands of tons e Argentine Republic, to Uruguay and to South Africa. amship out of fuel gets British coal when she drops into coaling stations as Maderia, the Azores, Rio Janeiro, , or Port Said at the Suez Canal.

e and Rapid Development of American Coal Mining.— g the first two-thirds of the nineteenth century, while nd was busy manufacturing with coal, the people of the l States were chiefly employed in farming and settling e lands of the Mississippi Valley which the United States nment was giving away to settlers, who rarely needed r the family stove. Our manufacturing industries started, the improvement of the steam engine, in New England, many streams tumbling down from the highlands made nt waterfalls and good water power, of which we can see dence in the names of old New England mill towns, such l River, Chicopee Falls, Rumford Falls, Bellows Falls, any others. For domestic fuel the American people for enturies burned wood, while England, old and rela-populous, had been short of forests in Queen Elizabeth's nd was using coal. In 1660 the British consumption o-fifths of a ton per capita, a quantity not equalled in the States until after 1850.

all coal field near Richmond, Virginia, was but a few om tide water at that city and because of that fact was, in s before railroads and canals, the most accessible to eastern s, because it could be carried to them over the natural ays. The northward movement of the coal began in

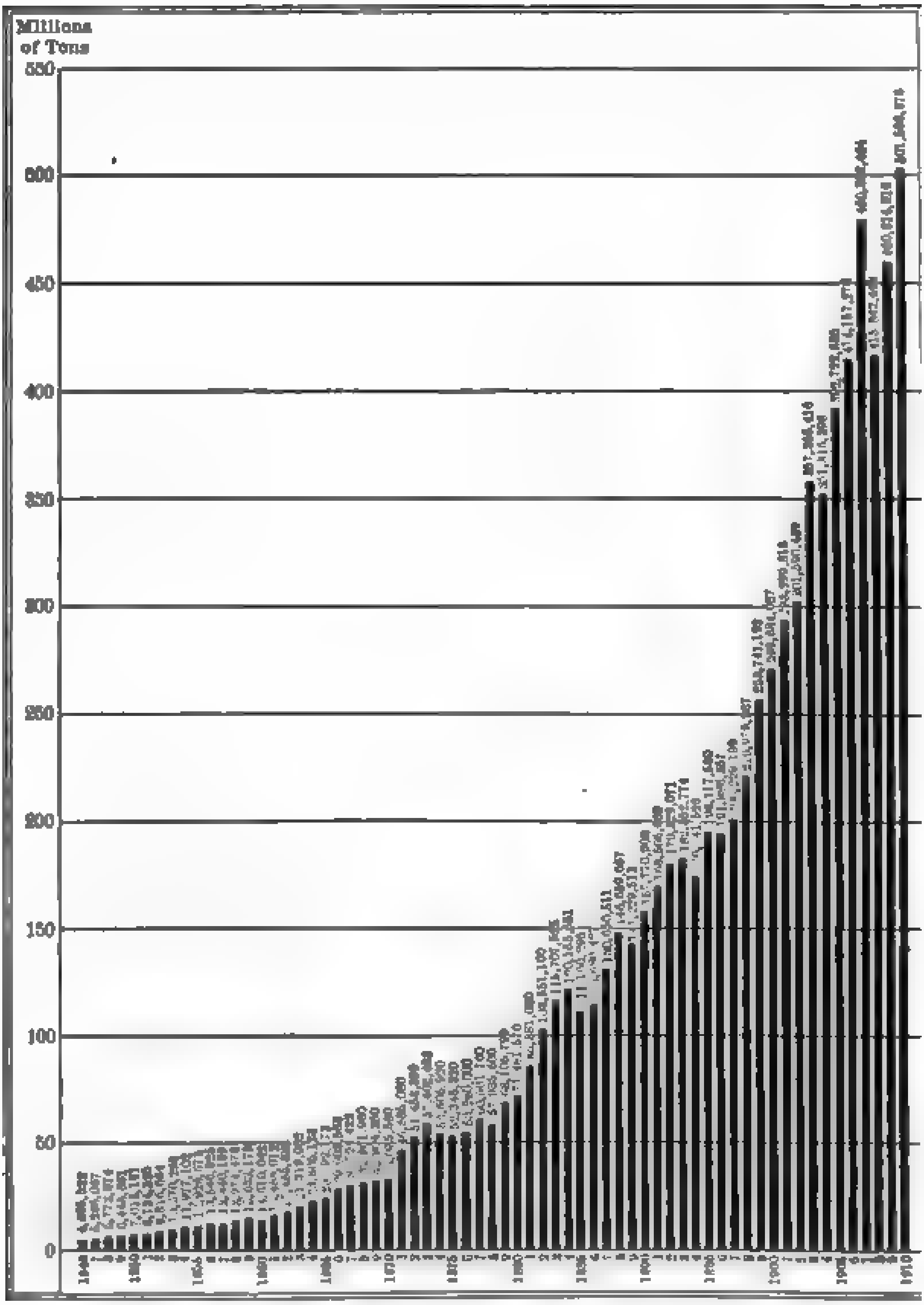


FIG. 124.—Production of coal in United States, 1846–1910.

), and this trade was used as an argument for the building he Chesapeake-Delaware canal. This Richmond coal field, entirely abandoned because of the competition of its suors, was yielding 54,000 tons a year in 1822, while the Pennania anthracite, of which the first shipments were made by on in 1807, had reached a production of a ton a day by 1820. Pennsylvania anthracite deposits served as a magnet to ict the pioneers at both canal and railroad building, a highof each type being built up the Schuylkill River from Philahia to the southern edge of the coal fields.

ır production only reached a million tons in 1837, 10 million 153, and 20 million in 1863, but the rapid development since Civil War is shown by its having reached 50 million tons in , 100 million in 1882, 200 million in 1897, 300 million in 1902, nillion in 1906, and now, for every man, woman, and child in country, we use annually over five tons of coal or over 25 ds per day. The rate of increase in per capita consumption een stupendous. The amounts with dates have been (1850) ' tons, (1860) 0.514 tons, (1870) 0.96 tons, (1880) 1.52 tons,) 2.52 tons, (1900) 3.53 tons, (1910) 5.1 tons. The connce of such a rate of increase is unthinkable.

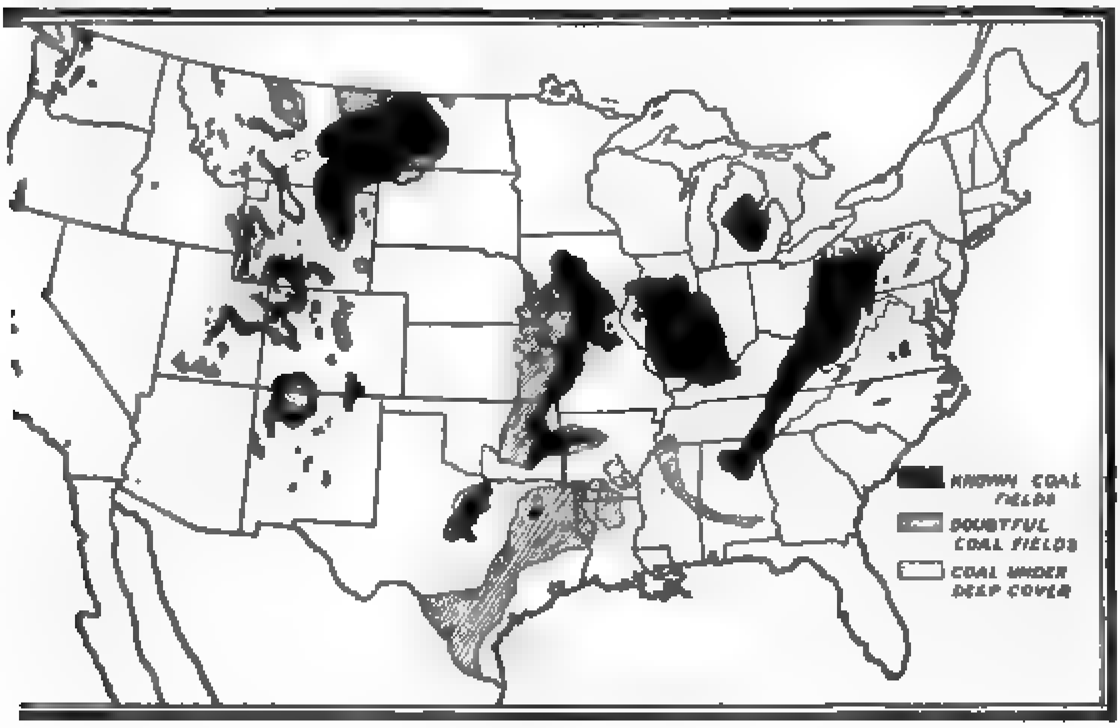
e Influence of Coal on Settlement of America.—It was coal team that enabled the American people to finish the conof the American continent. In the two centuries between ›unding of Jamestown and the marketing of coal in Pennnia, the colonists had slowly struggled westward through orests and mountains and settled the river districts of rn Pennsylvania, Kentucky, and Ohio, but the conditions nsportation in the west were such that no populous commonh could arise. Exports of grain and meat and a little r went to New Orleans down the Ohio and Mississippi s in flat boats which were knocked to pieces because they not be pushed up stream against the swift current. Imwere brought in wagons over the Allegheny mountains to urg and thence down stream to the points where they were ned. Economic and social progress was difficult under conditions. In 1812 the steamboat changed all this by ling the Mississippi River and making a two-sided commerce. abled American people emigrating by the power of

steam to attack the heart of the continent in a hundred places on the great navigable system of the Mississippi between Pittsburg, Kansas City, Minneapolis, and up-stream points on many smaller rivers. Two decades later the steam-driven locomotive broke the shackles that had for ages held civilized man by the river bank and seashore, so that in half a century the American people spread five times as far as they had in the two preceding centuries.

Pennsylvania Anthracite.—The first coal field to be extensively developed in response to the steam demand was the anthracite field of eastern Pennsylvania, which has the best coal in America and is also nearest to the cities of the Atlantic Seaboard. The canal built up the Schuylkill from Philadelphia to this field was followed by some of the earliest railroads in America. Every railroad system anywhere near the district has reached out for a share of the coal freight until now a dozen railroads carry this coal in all directions, to Philadelphia, New York, and New England, on the east, to the Great Lakes on the north, and to the west, and the south. This coal, being the nearest to New England, is very important there, but is a luxury on the Great Lakes and in the west, because there is so much bituminous coal near at hand in Ohio, Indiana, and Illinois. At Port Richmond, a terminus of the Reading Railroad in Philadelphia, are extensive coal piers from which 2 millions of tons of anthracite are shipped to New England in barges towed by sea tugs, while 14 million tons are shipped from piers of the Lehigh Valley, Delaware, Lackawanna and Western, the Pennsylvania and other railroads from their docks on Raritan Bay and Hudson River near New York. The United States has a production of nearly 1 ton of this valuable coal per capita per year, all produced in the small coal region of eastern Pennsylvania. Here the scattering remnants of a deposit once of greater area are divided into three fields covering an area of but 475 square miles with the cities of Scranton, Wilkesbarre, Pottsville, and Shamokin as the chief mining centers.

The improvements in methods of burning small sizes of anthracite coal have caused the closer utilization of the output and led to the re-working of the culm banks left by the mining operators of past decades. These reclaiming plants, called washeries, sent 4 million tons of coal to the markets in 1909.

he Appalachian Bituminous Coal Field.—The Ohio River ned the finest bituminous coal field in the world—the Appa- ian coal field, reaching almost without a break from northern nsylvania into northern Alabama. In western Pennsylvania e the coal area is larger than Massachusetts, Rhode Island, and aware combined, and Pittsburg, standing where the navigable o was formed by two navigable branches, was the most venient point of access to this coal field and the natural e for its earliest development. All routes gathered at Pitts- g, and the so-called smoky city, depending entirely upon



125.—Map showing general distribution of coal fields in the United States. (U. S. Geol. Surv.) (From W. S. Tower.)

lachian coal for its manufacturing power, grew rapidly. service of these streams in the formation of Pittsburg is than that of a mere converger of highways through the tains and plateaus. In 1909, the Monongahela River ght 10 million tons of coal to the city out of a total shipment million tons.

these Appalachian plateau districts the opening of a coal in a practically unsettled forest, or a farming district, neces- s the building of a new town in the wilderness for the rt of the mine workers. The coal mining company usually the houses as well as the branch railway to get to its mine. h year acres and acres of barges of Pennsylvania coal

float down the Ohio and Mississippi carrying millions of tons to Cincinnati, New Orleans and other cities along the great waterway. A dozen railroad tracks deliver it with great ease to the steamships upon the Great Lakes or carry it over the Alleghanies to the cities of the east where it is much used in

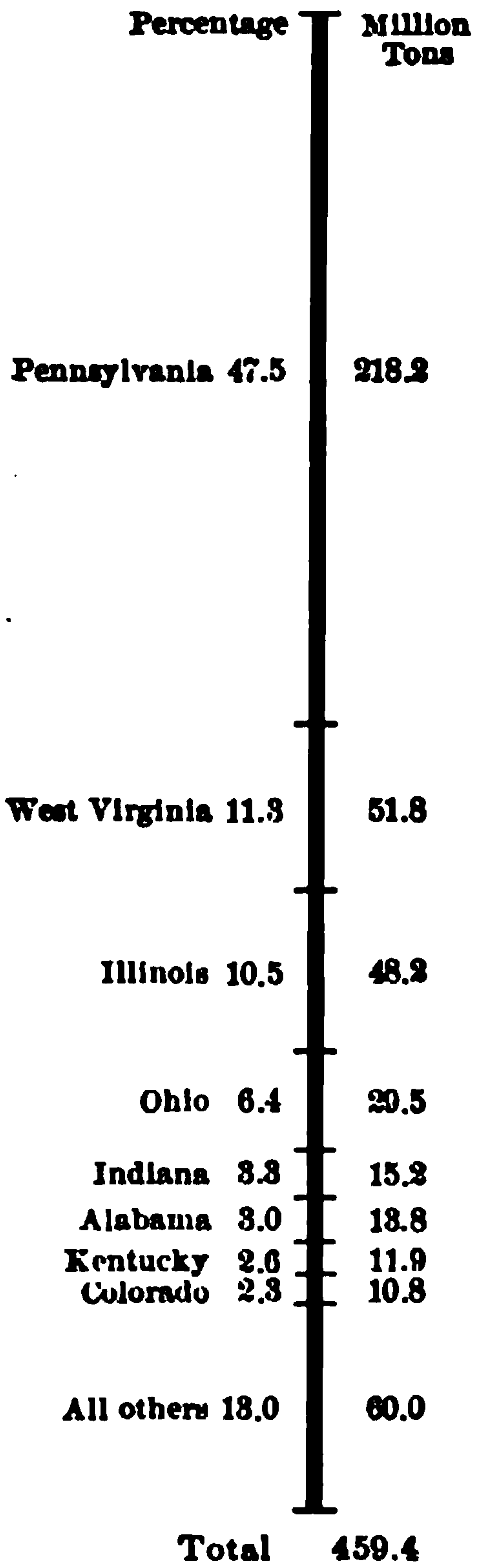


FIG. 126.—United States coal production by states, three-year average, 1908–10.

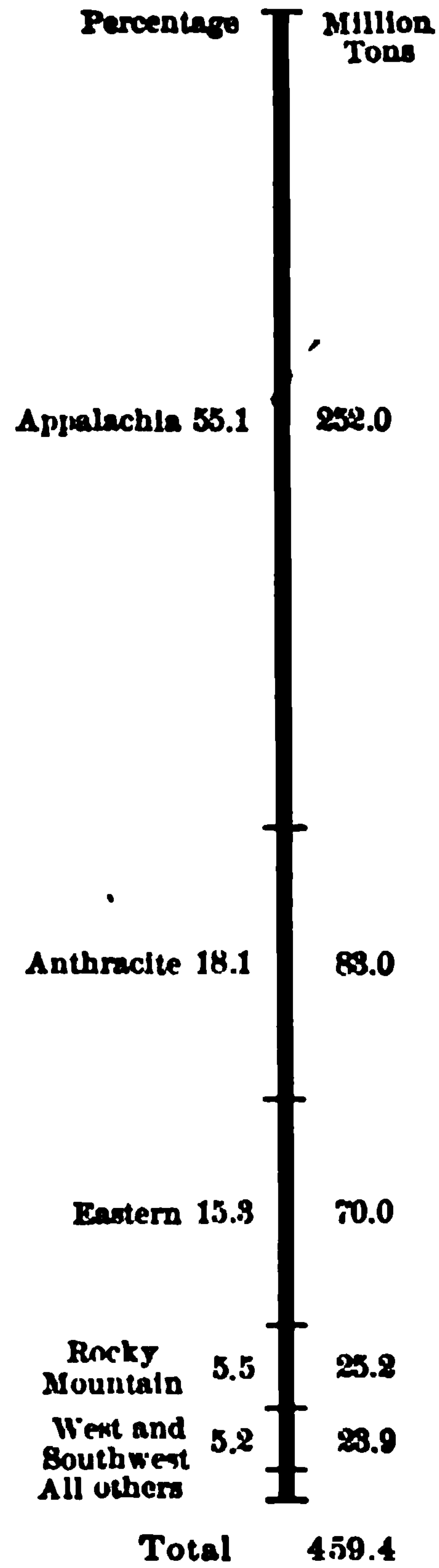


FIG. 127.—United States coal production by fields, three-year average, 1908–10.

factories and engines because it is cheaper than the clean but expensive anthracite which is so much prized for heating houses. In 1909 Philadelphia used 4 million tons of anthracite and 2 1/4 million tons of bituminous, New York 11 million anthracite and 4 million bituminous.

ie southern extension of this Appalachian coal field in West nia, eastern Kentucky, Tennessee and part of Virginia not so early developed because more difficult of access. At present time there is in eastern Kentucky 10,000 square of this Allegheny plateau underlaid with coal where the gorges of the many streams which cut it are so difficult avel that there is no railroad, and no coal mining, and the e thus isolated are living the life of the pioneers and back-smen of the Revolutionary period. West Virginia, not accessible as Kentucky, but less accessible than the Pitts- district, now has, as a result of recent railroad building, idly increasing coal output. The West Virginia coal fields ifficult for railroads to cross and the valleys are so narrow the houses of the mining towns are perched row after row the steep slopes that rise directly from the streams.

e southernmost of these eastern coal fields is in Alabama Birmingham. It is very accessible to adjacent markets has greater development than any field south of West nia. The recent building of locks and dams in the Warrior has enabled the carriage of this coal in boats to Mobile ie supply of steamships and for export to Gulf and Carib- ports.

e Distribution of Eastern Coals.—The Appalachian coals a very central location for that part of the continent east Mississippi River and the whole region is reached to some t by the Appalachian product. Considerable quantities of Virginia coal are shipped by rail to Baltimore and thence ater to northern points. The coal shipments by water Hampton Roads (over 7 million tons, 1909) are nearly times as great as those from Philadelphia and rapidly ng.

coal freights as they exist in the United States are a r cause of wonderment and leave much for the social mist to explain. To carry anthracite from the Schuylkill to Philadelphia, a distance of about 100 miles, the rate il in 1909 was respectively $1.70, $1.40, and $1.25 per ton ling to the size of the pieces. From New York bay to England by boat it varied from fifty-five to seventy-five per ton. From Hampton Roads to Boston it was sixty

cents per ton (in steamers carrying 6,000 tons), and the ye before it had been forty cents. From Lake-Erie ports Duluth, the rate on Pittsburg coal is thirty cents and to M waukee thirty-five cents, so that New England, Minnesota, ar Wisconsin have a surprising evening of opportunity with t coal-producing states. With Pennsylvania bituminous wor $2.50 at New York Harbor (1909) and Virginia Pocohontas (us by the United States navy because it is one of the best coals the world) at $2.15 per ton at Hampton Roads it is plain tha in connection with the very cheap freight rates mention above, New England coast and points have a very cheap fu supply in the cheap Virginia coal brought to tide water by t Virginian railway. This new and specially constructed co road has somewhat disarranged the coal trade by displaci some Pennsylvania coal and some Nova Scotia coal in Ne England ports.

The Interior Coal Fields of America.—The eastern interi field, southern Illinois, southern Indiana and western Kentuck is second in importance only to that at the headwaters of t Ohio. The coal, bituminous, is not so good a variety as th of the Appalachian fields, but its nearness to Chicago, St. Lou and the manufacturing centers of Illinois and Indiana mak it the chief dependence of those regions and the output is great than that of Pennsylvania anthracite.

It is an interesting fact that the quality of American co declines as we go west until the Rocky Mountains are reache so that the large western interior and southwestern fields exten ing from central Iowa to central Texas are inferior to those Illinois and Indiana and are not so extensively mined. Beyor these the yet inferior lignites that underlie vast areas of t plains of Dakota, Montana and Wyoming are mined only f local use. The Rocky Mountains, which with their adjace plateaus embrace almost one-fourth of the United States, a a region of such sparse population and vast extent that the coal resources are not fully explored. Each year the scientists the Geological Survey find thousands of square miles of adc tional coal and it is already known to exist in every state fro New Mexico to the Canadian boundary. The total quanti will doubtless be very great and some of it is anthraci

ality. Much of this western coal land still belongs ed·States Government and is being held as a reserve ture needs of the nation. It is hoped that it will fort for the many rather than colossal fortunes for a sery for many.

oast and Alaska.—The Pacific e only part of the United ich suffers for lack of coal, product being less than 1 per at produced in this country, sources are meager. The aver- f coal per ton at the mines of nd Washington in 1909 was West Virginia it was $1.086. is even worse off than Oregon hington because it has an available coal so small as to lly negligible.

reason the development of res was greatly hampered in and the railroads even had to and $12 per ton for coal for motives. The discovery of in large quantities in 1901 fuel scarcity.

mplete knowledge of Alaska is dly extended, and one of the f this erstwhile little esteemed s valuable deposits of coal and The coal veins are of astonish- ness and small parts of them y estimated to be worth scores s of dollars and their disposi- een the subject of fierce political controversy.

FIG. 128.—World's coal production, three-year average, 1908–10.

n Coal.—Canada is richer in coal than any two nations , but her production at the present time is small in n to that of the United States, which leads the world. cotia there is a coal field near the sea, and water trans- which enables it to be marketed in New England.

Thus it happens that New England desires free trade in coal and Pennsylvania desires a tariff on coal. The most populous parts of Canada in Ontario and Quebec are without coal and import several million tons across the Great Lakes and the St. Lawrence from the nearby fields of Pennsylvania and Ohio. The coal fields of Montana and the Rocky Mountain region are continued in Canada where a little coal is mined for local use in the Rocky Mountains. Fortunately, Vancouver Island and the adjacent mainland of British Columbia have coal, much more coal than the adjacent parts of the United States to which for many years some of the coal has been exported by sea.

American Commerce in Coal.—Despite our enormous coal resources and world-surpassing production, the coal export of the United States is relatively insignificant. Nearly all of it goes to Canada, but small amounts are sent to Mexico, Cuba, and the West Indies. Regular lines of vessels have long carried coal from Norfolk to Tampico for the supply of the Mexican railroads and mines.

The small export should not for an instant cause any one to lose sight of the enormous part that coal plays in American railroad traffic. The entire wheat crop of the United States does not weigh as much as half the coal produced in Illinois or West Virginia. The entire cotton crop of the United States only weighs a quarter as much as the coal product of Alabama and only an eighth as much as the coal imports of New England.

AMERICA COMPARED WITH FOREIGN COAL PRODUCERS

(Coal Production in Million Tons)

	U. S.	Gt. Bri.	Germany	Austria-Hungary	France	Belgium	Russia	Japan	World
1869.	32	115	36	7	14	13	1	0	230
1889.	141	190	93	27	26	21	6	2	530
1909.	460	295	239	53	41	25	26	16	1,227

Most of this coal carriage is entirely unnecessary. Central power plants at the mine mouth could generate power quite as cheaply as in more expensive town locations. Experience has shown that it can be transmitted at least 200 miles by

ricity. Most of the people and most of the cities of the ed States are now within that distance of coal mines. We transmission wires to replace freight trains.

coal lands the United States has over 496,000 square miles being mined in twenty-nine states and with an estimated able supply as follows:

nthracite	21,000,000,000 tons
ituminous	1,661,000,000,000 tons
ub-bituminous or black lignite	650,000,000,000 tons
ignite	743,000,000,000 tons
Total	3,076,000,000,000 tons

is amount 1,922,000,000,000 is easily accessible and 1,153,-00,000 is accessible with difficulty. We have still on hand 99 per cent. of the total original supply, but we are wasting, process of mining, one ton for every two we get.

e resources of the United States are much greater than of Europe. While coal underlies nearly one-sixth of the of this entire country, Russia has only 20,000 square miles he United Kingdom but 11,900. Germany, with less than square miles, is next to England the greatest European cer, because Germany has within the last forty years had ormous development of manufacturing that depends upon emands coal. France is very poor in coal, her chief fields near the northern boundary and extending across into im, which country, like France, is an importer of British This inadequacy of the French coal supply is doubtless f explanation of the small number of factories in com-n to England, Germany or the United States. France arcely be called a manufacturing nation and unlike her ors still virtually feeds herself. The Russian coal fields gely undeveloped.

poverty of European as compared to American coal is well shown in the comparative prices and produc- of miners.

pite the introduction of machinery in European mines tput per man is declining and the cost is increasing. We iere one of the reasons why the Germans lead the world scientific utilization of coal and coal products.

	Yearly output per miner in tons		Cost per ton at mine
	1899	1908	1909
England	311	279	2.05
Germany	264	246	2.45
France	211	189	3.08
Belgium	173	160	3.11
United States:			
Anthracite	433	478	1.84
Bituminous	713	644	1.07

Coal in Tropics.—There is a great scarcity of coal throughout the torrid zone. The whole continent of South America is practically barren of coal save for a few small deposits upon the Andean plateau in Peru, and a small field in Chile which does not supply the needs of that country. In 1910 the production was a million tons and the import a million and a quarter. There is none in Central America, but little in Mexico, and the whole continent of Africa seems to be poor in coal, there being no production at the present time save a little in Natal which by no means suffices for the supply of South Africa. India also has but few coal fields, and the quality is not good. The East Indian Islands are equally barren, a small amount of inferior coal being found in Borneo and the Philippines.

Australia, Japan, New Zealand.—Australia and New Zealand have enough for their own needs, but their resources are not great and the production, like that of Japan; is about that of a fourth-rate American state. The Japanese coal resources are limited and the product is of rather inferior quality, but is of very great importance to that country which is rapidly developing manufactures.

The Resources of China.—The Chinese Empire is credited with having coal resources several times as great as those of all Europe, but not equal to those of the United States. Our Pennsylvania anthracite underlies less than 500 square miles, the veins are twisted and broken, but a German geologist reports that the province of Shansi in the valley of the Hoang-Ho west

in, contains a single deposit of 18,000 square miles of coal ennsylvania anthracite, lying in thick seams, level and urbed, and outcropping on hillsides so that trains can run nto them. Extensive deposits of good bituminous coal nd in practically every one of the eighteen provinces of proper and reach far into the interior as well. At the time the production is just beginning, the millions of

—Coal tipple, coke ovens and miners' village in bituminous field, West Virginia. (Philadelphia Museum.)

aving left their coal untouched during the forty centuries activity in that country. But coal mining has begun in A new viceroy at Canton recently announced that r only Chinese coal would be used by the governments of Kwang provinces lying opposite Hong Kong. New coal re being opened in that vicinity (U. S. Con. Rep., April). Railroad building is now in rapid progress, and some that in the next twenty-five years China will build more than the rest of the world combined. Her coal resources uestionably be utilized, for they are very accessible as rich and vast. The possibilities of manufacturing in

such a nation with such resources of fuel and labor are enormous.

Methods of Mining Coal.—The methods of mining coal vary greatly. In western Pennsylvania and West Virginia the coal lies in a high plateau through which the streams have cut valleys so that the coal outcrops on the hillsides, making the entrance to the mines exceedingly easy. Near Pittsburg the railroads must climb up two or three hundred feet from the rivers to get to the mine mouth. In many parts of the Rocky Mountains and

Fig. 130.—The little mine car brings the coal to the wasteful beehive ovens and the box car carries away the coke.

the Great Plains the coal outcrops are so abundant that the scanty population can be supplied by going to the cliffs, bluffs, or river banks and digging it down with the pick and shovel and hauling it away in the farm wagons. These conditions of easy access are very different from those existing in Europe and in the anthracite fields of Pennsylvania. Pennsylvania anthracite lies in the folded and bent strata of mountains, the pressure of mountain-making having turned the coal to anthracite. It may outcrop

ıe places, as at Hazleton, so that it can be quarried from the e. Nearby it is buried 3,000 feet in the ground, requiring hafts which go below the level of the sea and involve much g of rock, pumping of water and lifting of coal. Then the ıcite requires much sorting, cleaning, and preparing to get r of the shale so that 10 per cent. of the coal is used in the

1.—A large building is required to prepare anthracite coal for market and the earth is encumbered with refuse.

g, while in bituminous mining in United States but 2 to 3 ·nt. is so used.

mines of Europe are almost universally deep, some of the descending nearly a mile into the earth.

r Methods in The Utilization of Coal.—The greatest uses l are for engines—factory, locomotive, or steamship—for ›mestic fire, for the smelter that extracts metals from ores,

for the electric power house and gas works. The locomotive is a tremendous user and a tremendous waster of coal. In the year 1910 the American railroads spent $213,000,000 for locomotive fuel and only 45 per cent of the fuel was utilized for effective work (*Railway Age Gazette*, Nov., 1911). The locomotive is much harder to use economically than the engine of a large

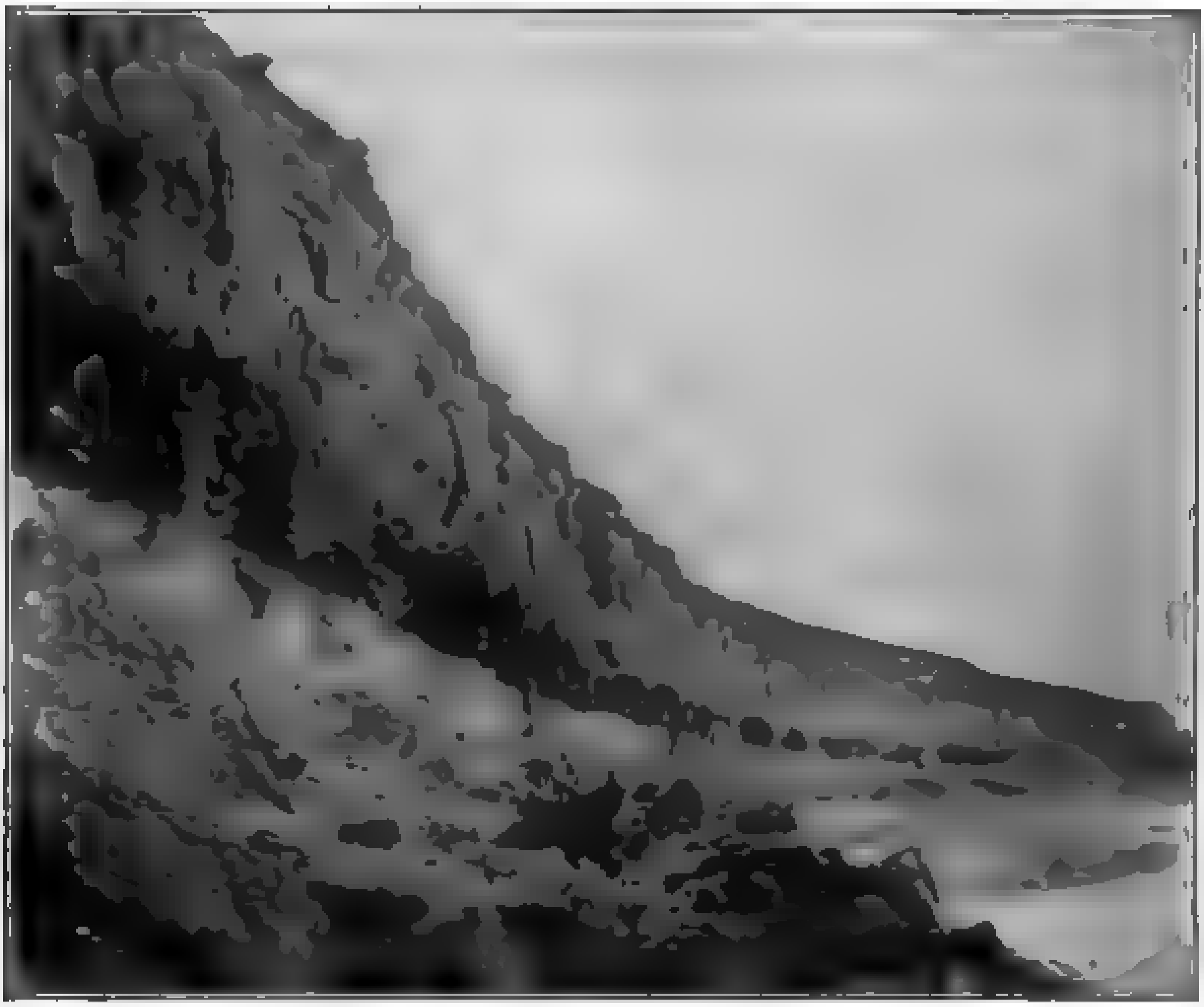
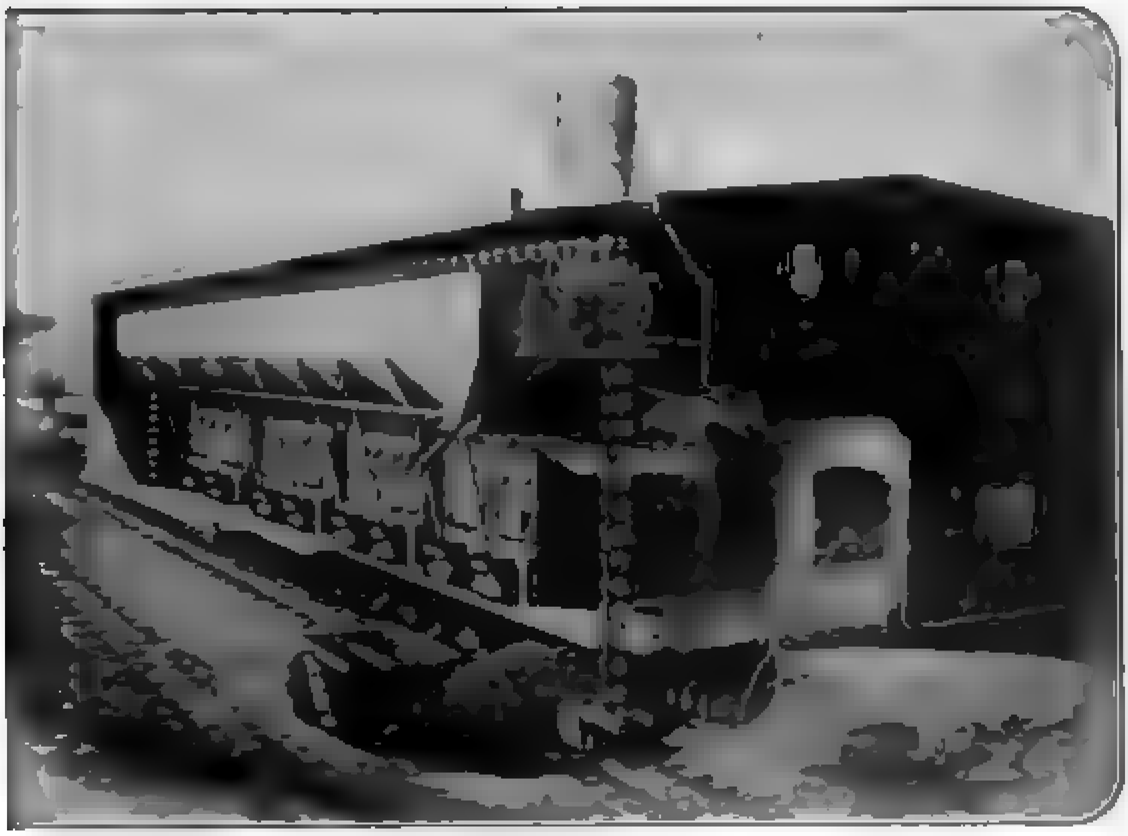


FIG. 132.—Man standing in front of coal seam outcrop in banks of Yellowstone River, Montana. Blocks of fallen coal in foreground. In a few places in the West farmers go to such banks and load their wagons. (Campbell, U. S. Geol. Surv.)

power plant. At some large power plants the handling of the coal from the time it drops through the bottom of the car alongside the boiler house until it passes over the grates and finally, as ashes, gets back into freight car outside the building is done entirely by machinery, so that one or two men can control an apparatus which consumes carloads of coal each day.

Recent improvements in gas engines and the new process of

ng the gas called producer gas promise to be revolutionary. his process gas can be made of coal or coal material of any from anthracite to the peat of the bog where it is now ; deposited. Thus, the brown coal or lignite of Texas the Dakotas does not have to await the slow geological ss by which it could be changed to bituminous or anthra- These geological processes, by driving off volatile con-, increase the carbon percentage which in wood is only er cent to over 80 in good bituminous and over 90 in



33.—Power plant where mechanical device converts coal into ashes and loads the ashes on the cars.

anthracite coal. The producer gas plant can get out the ustible carbon in the form of gas from any of these coals, peat itself, from wood, tan bark refuse and even from sewage, although these latter have not been used on a nercial scale. This process of using peat offers great power bilities to many lands poor in coal but rich in peat, such as nd, where one-fifth of the surface is covered with peat bogs. also covers large areas in Scotland, Sweden, Denmark, a, Canada, and New England. It is an important domestic

fuel in the European countries. Germany uses 10 million tons per year. The Dismal Swamp, south of the mouth of the Chesapeake, is a peat bog 20 to 25 feet in depth covering several hundred square miles and having material which would make millions of tons of coal in some millions of years or can make millions of horse-power of energy right now if put through the producer gas plant and the gas engine.

Recent experiments in Sweden have shown that a ton of coal costing $3.95 was equal to only 1,214 tons of dried and pulverized peat costing $2.76 and burned in a dust blast under a boiler—another suggestive way of enriching the peat owning nations (U. S. Con. Rep., May 25, 1911).

Briquettes are compressed lumps of coal made by mixing small particles of coal with some adhesive material and pressing it in molds so that it holds its shape until burned. In Germany 17 to 18 million tons of briquettes are made annually while the industry is only getting started in the United States after many years of trial. Germany has more expensive fuel, cheaper labor and a great abundance of binding material in the tar from her by-product coke ovens. The United States is somewhat lacking in all of these respects, but "there is an abundant supply of raw material which can be used for briquettes and in the utilization of which one of the greatest steps in the practical application of conservation principles could be made. This consists of materials which unless used in this way are wasted. The classes of low-grade fuel available for this purpose are: (1) anthracite culm; (2) slack coal from semianthracite, bituminous, and sub-bituminous coal mines, which does not possess fusing or coking qualities, and is therefore not available for the manufacture of coke and which is in many cases burned to keep it from "cumbering the ground"; (3) lignite, which disintegrates on exposure to air, will not stand transportation to distant points, and cannot be stored for any length of time; (4) coke breeze, which possesses high fuel efficiency, but which, because of its small size, cannot be used as such either for domestic or other fuel. The quantity of this coke breeze produced in the United States each year and practically wasted at the present time is from 2 million to 3 million tons; and (5) peat, which usually occurs at long distances from the coal supplies, and

ch, if properly prepared, makes an excellent fuel." (From *ıeral Resources*, U. S., 1909, Vol. II, p. 198.)

. satisfactory process of briquetting already in use at Trenton, r Jersey, and elsewhere is making anthracite coal dust into ıbstitute for the large anthracite coal.

oke, Gas, and Gas By-products.—For the making of iron it ecessary to use coke. This fuel is made by heating coal in ɜd retorts where the gas is driven off and the coal is left in lumps that are harder than the coal itself was and therefore up the burden of the ore so that the fire in the blast furnace not smother. In coke making sometimes as much as 00 cubic feet of gas per ton of coal may be entirely wasted ;he old-fashioned bee-hive oven, or saved by an improved roduct oven. The purification of the gas from the by-product ı gives several pounds of crystallized ammonia and several ns of tar per ton of coal. The ammonia is a valuable lizer, the tar is used for roofs and roads besides furnishing st of chemicals and dyes.

ıe Germans, scientific, thrifty and poor in coal, lead the d in the manufacture of by-product coke, gas engines and tar by-products.[1] Meanwhile we in America are wasting in the old-fashioned bee-hive coke plant, in wasteful engines in wasteful mining where coal once left in the worked mine never be recovered. These facts in combination with the l increase of manufacture and commerce are causing some ı for fear of possible exhaustion of our coal resources at a ı earlier time than we previously thought. The price of ;s rising and must continue to rise. This turns our attention ı toward substitutes of which the chief are water power petroleum, now both in active competition with coal. Of , the oil may have an advantage of cheapness while it lasts, ıll the minerals are at best an accumulation soon robbed are but ephemeral in comparison to water power which,

ıe proportion of coal coked in by-product ovens in Germany was 30 nt. in 1900 and 82 per cent. in 1909; in England, 10 per cent. in 1900 ; per cent. in 1909; in the United States, 5 per cent. in 1900 and 16 nt. in 1909.

908 the German coke ovens consumed 30 million tons of coal, made cent. as much coke, and as by-products 630,000 tons of tar worth ,000, 60,000 tons of ammonia worth $13,000,000, and 60,000 tons of worth $2,000,000.

depending upon the sun, the sea and the high lands, remains an enduring source of power while climate and land endure.

4. WATER-POWER

Water-power Resources.—The water-power resources of a country are affected by many circumstances. If the land is high like Norway it may be rich in power from waterfalls which are so absent from flat lands like Holland, Denmark, and Delaware. The seasonal distribution of the rainfall may give three months' flood and six months' drought in which torrents become dry stream beds, a condition found in monsoon countries and where the Mediterranean type of climate prevails. Here water-power plants may be idle a large part of the year unless there is some kind of water storage.

The water runs away more quickly from hilly than from level land. Even where the rainfall is well distributed throughout the year, there is, in small short streams, a great variation because of the quick running off of the water after rain. A large river system tends to even up these inequalities.

The most important factor affecting water-power is some form of natural water storage. The spongy leaf mass of the forest floor holds water and makes more even stream flow and better water power on the forest stream than on one draining tilled lands. Swamps and marshes are better yet and lakes are best of all. Man improves streams by building dams to serve as reservoirs and hold the water, but the natural reservoirs of lakes are manyfold better, and hold waters that would otherwise be wasted in freshets, and let it out in time of drought. As most of the world's lakes are due to the action of glaciers, the fact that an elevated region has been glaciated is, granted rainfall, the most important thing in deciding its water-power resources. Lake Superior has in it enough water to run the St. Lawrence River for a century and the part that would flow out would keep a river running for many months after all rainfall had ceased. Thus the Niagara River with its wonderful natural reservoirs varies but little in volume, while the lakeless Potomac may be waded across one week and the next is an uncrossable torrent 20 feet deep.[1]

[1] The Niagara drains 88,660 square miles of reservoirs and has a maximum flow 35 per cent greater than the minimum. The Potomac with no lakes

lds and glaciers are next to lakes as natural reservoirs r have the particular advantage of releasing the water f summer drought.

ent increase of attention to conservation of resources d an estimate to be made of our water-power resources.

HOWING ESTIMATE OF STREAM FLOW AND WATER-POWER IN THE UNITED STATES[1]

ncipal drainages	Drainage area, square miles	Flow per annum, billion cubic feet	Horse-power available: Primary or minimum	Horse-power available: Minimum of six highest months
antic to Cape Henry, Va..	159,879	8,942	1,702,000	3,186,600
antic to Cape Sable, Fla...	123,920	5,560	1,253,000	1,957,800
f of Mexico to Mississippi	142,220	6,867	559,000	963,000
f of Mexico west of Ver-ver.	433,700[2]	2,232[2]	433,760	829,650
iver main stream.........	1,238,800	21,940	147,000	335,000
iver tributaries from east..	333,600	12,360	2,472,590	4,940,300
iver tributaries from west Vermillion River.	905,200	9,580	3,948,970	7,085,000
River to Canadian line....	299,720[3]	8,583[3]	6,682,480	8,090,060
ver, above Yuma, Arizona..	225,000	521	2,918,500	5,546,000
ific to Point Bonita, Cal..	70,700	2,193	3,215,400	7,808,300
ific....................	290,400	15,220	12,979,700	24,701,000
....	223,000	....	518,000	801,000
r,........................	62,150	614	75,800	212,600
....	4,508,289	94,612	36,906,200	66,449,310

imary horse-power is meant the amount which can be d upon the basis of the flowage of the streams for a period reeks in which the flow is the least. According to the all the installations in the United States were made to uch of the water as is available the lowest two weeks of

varies from 1,000 to 250,000 cubic feet per second.—*Review of* Vol. 41, p. 68.

, 1911, the drought caused the lakeless Catawba River to become t 152 Carolina cotton mills shut down for lack of power, throwing ratives out of employment for a time.

Conservation of Natural Resources in the United States," by Charles R. pp. 119, 120.

es Rio Grande in Mexico. [3] Includes drainage in Canada.

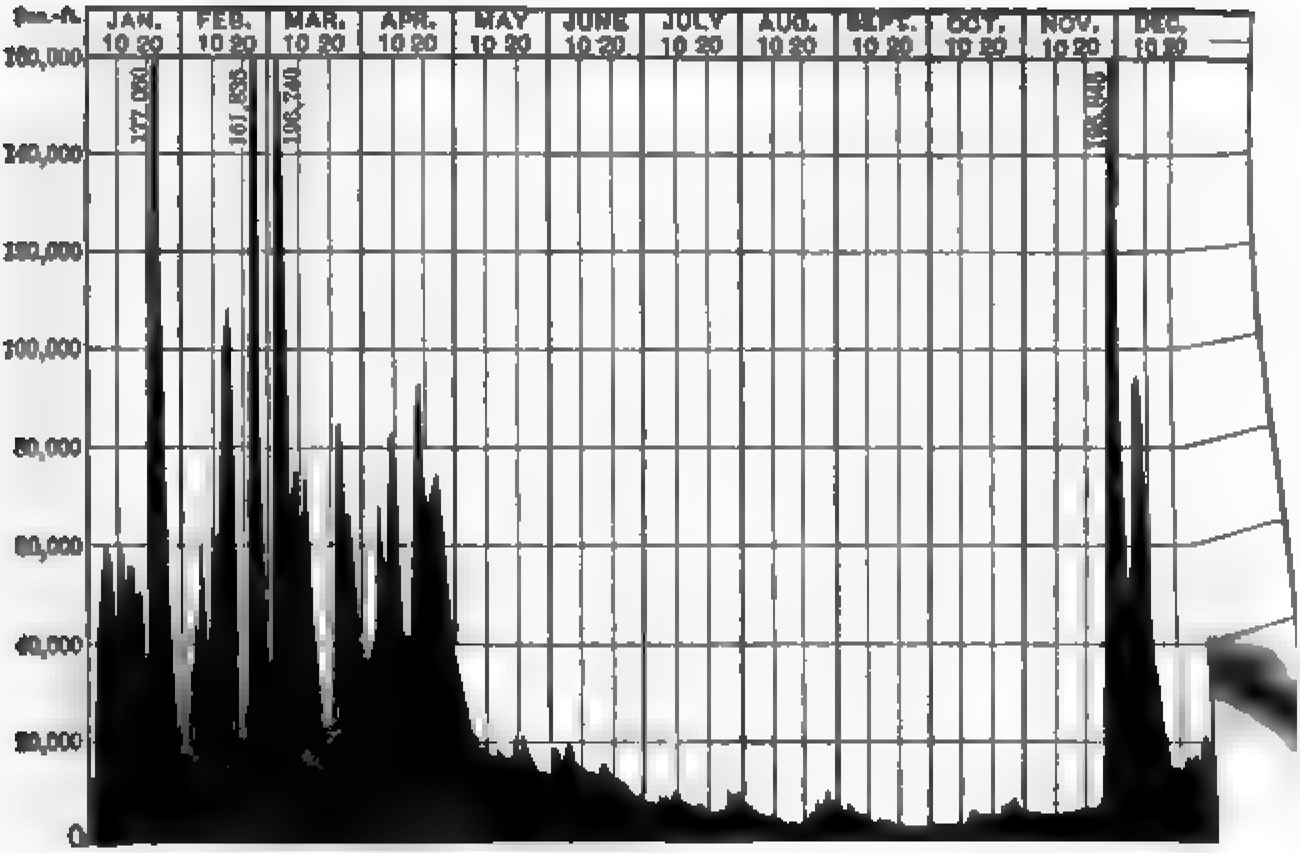


FIG. 134.—Discharge of water in 1900 from the Susquehanna at Harrisburg, a river with a practically lakeless basin with much steep land. (U. S. Geol. Surv.)

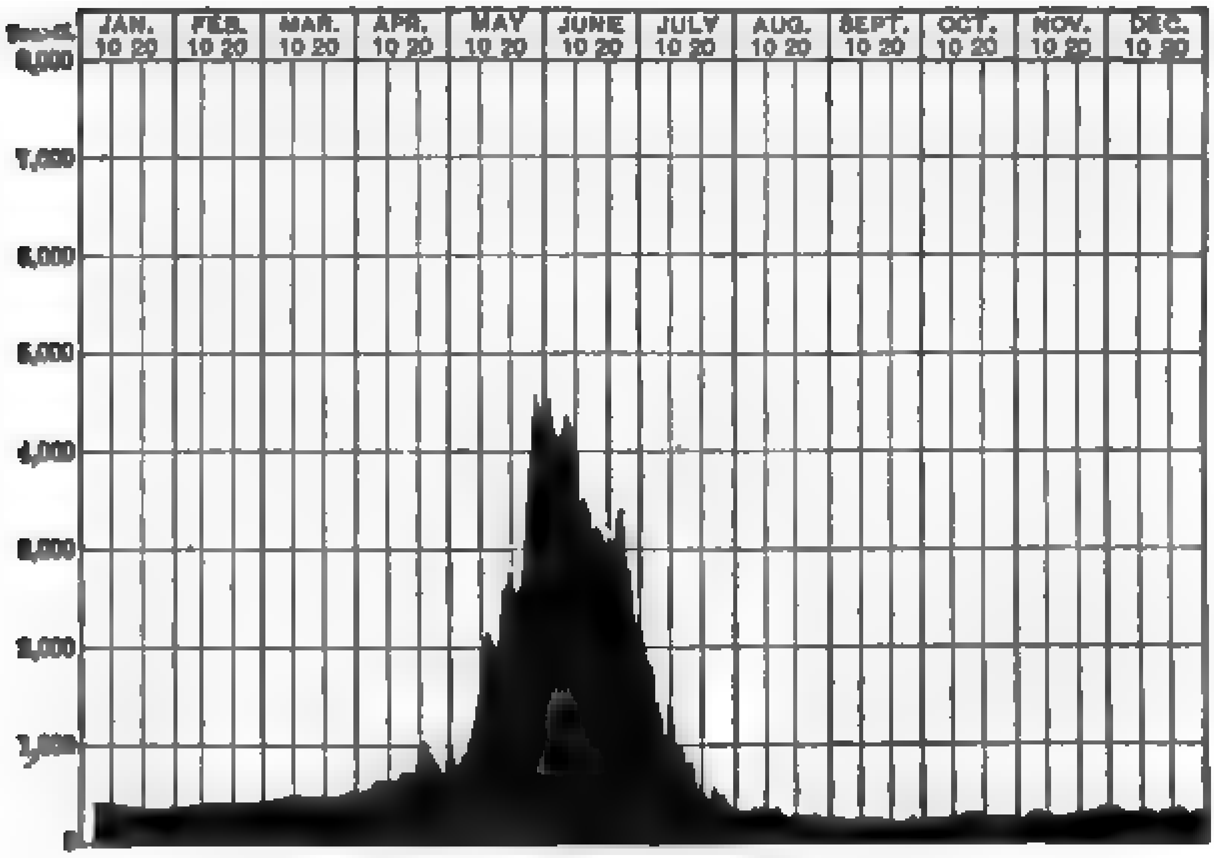
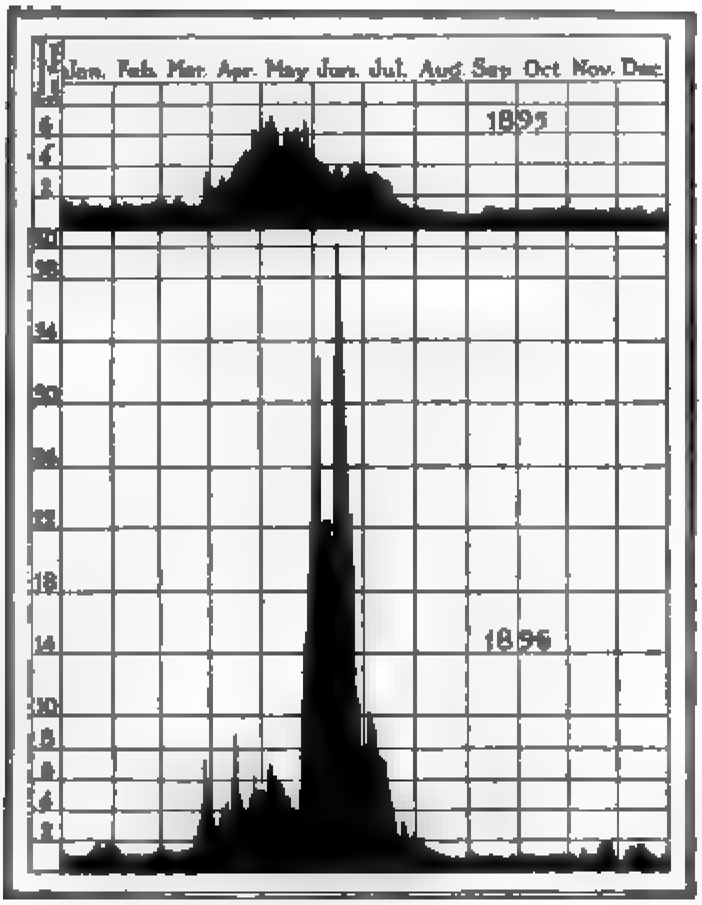
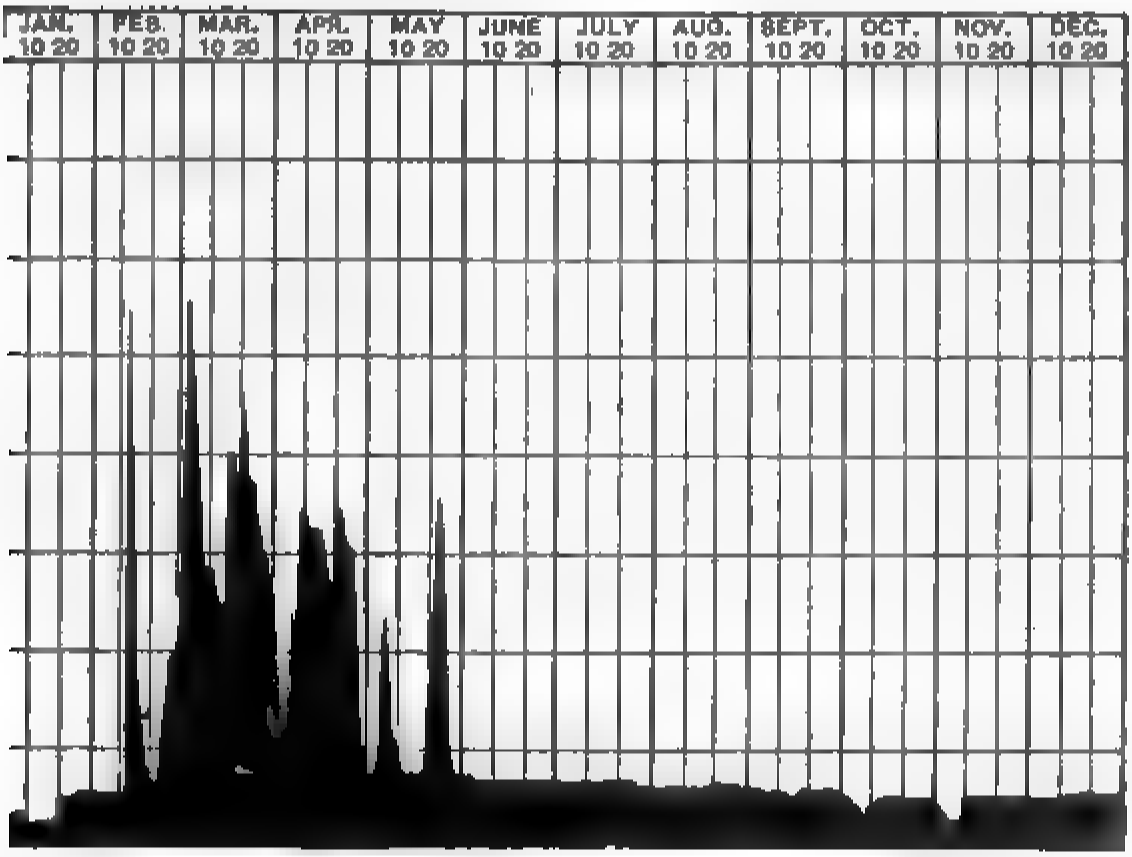


FIG. 135.—Discharge of water in 1900 from the Arkansas River, a stream fed by Rocky Mountain snows, near Canyon, Colo. (U. S. Geol. Surv.)



136.—Diagram showing discharge of the Boise River above Boise, Idaho, in 1895 and 1896. (Newell, U. S. Geol. Surv.) (From U. S. Tower.)



. 137.—Discharge of water in 1900 from the Cobosseecontee, a river draining lakes in the Maine woods. (U. S. Geol. Surv.) The attempt to make a discharge a uniform stream is one of man's supreme combats with the tainty of deadly nature.

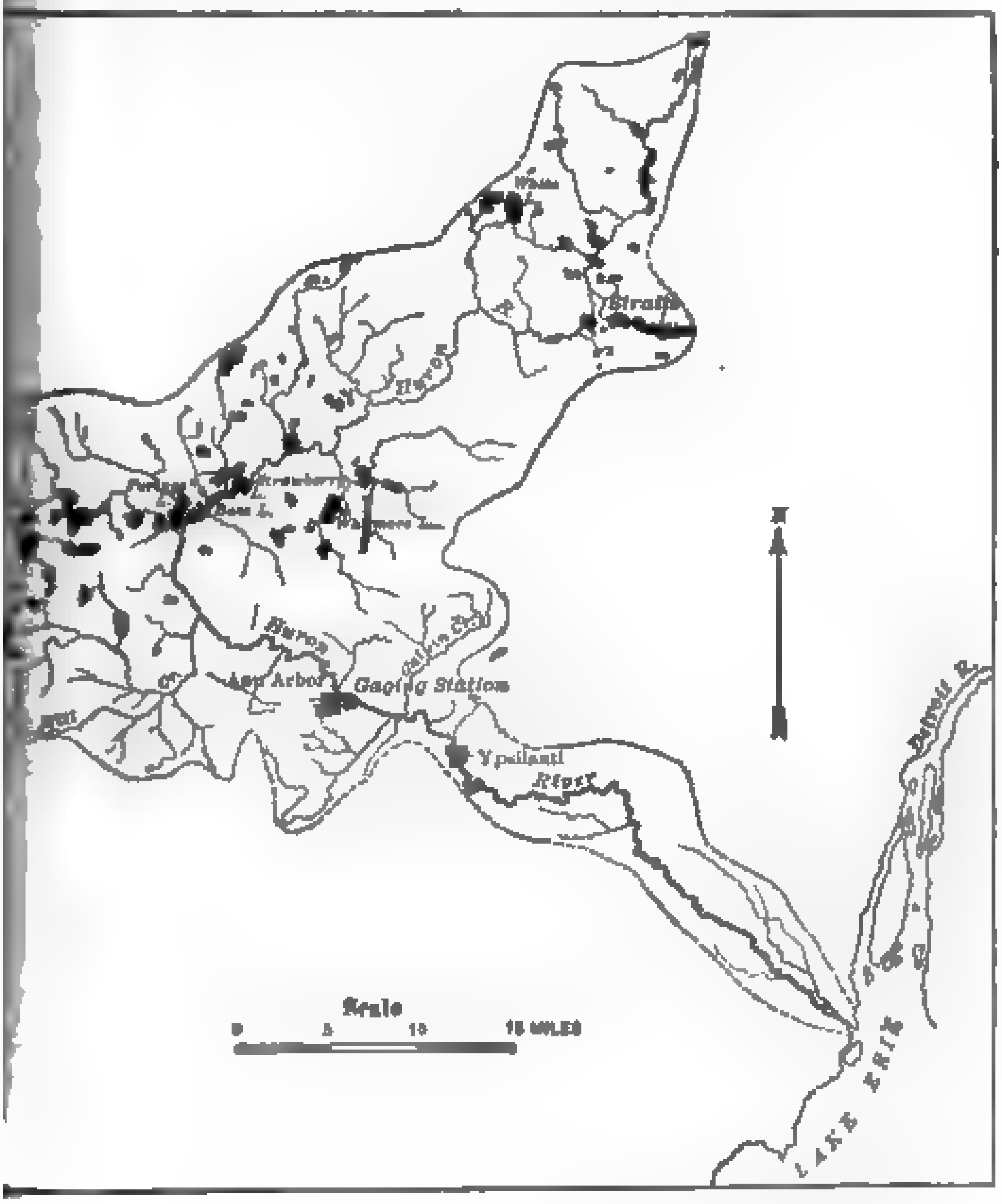
at McCalls Ferry, near the Maryland boundary, where by water wheels 100,000 horse-power of electric energy will eventually be developed. It can easily be sold as far away as Philadelphia and Baltimore, in which latter city the street cars are now being run by this Susquehanna power. This dam is merely one of

Fig. 140.—Modern hydro electric power plant, Cazadero, Oregon. Cement in dam, steel penstocks. (From Power Development by F. Koester.)

many that might be built on this river. Even the navigable Mississippi is being dammed at Keokuk, Iowa, where 200,000 horse-power will be developed while boats pass up through locks.

If we take a long point of view, the water-power of the glaciated region of northeastern United States is likely to have a much greater value than all the coal of Pennsylvania. The lakes and swamps and waterfalls of the glacial region produce power enough

ormous industries. Coal will go and the water-power The best example of this is to be seen at Niagara Falls, glaciers diverted a single stream across a cliff of rock, e Falls which will develop about 7 million horse-power ight if they are fully utilized. Hundreds of smaller ined have a greater power than even Niagara and many



Basin of Huron River showing the natural reservoirs afforded by glacial lakes. (Newell.)

re already in use, as in the wood pulp and paper industry scattered from Niagara Falls to eastern Maine. It was al water-power which started New England manufactur- e state of Maine itself is said to have waterfalls that will ossible total of 6 million horse-power, that is, about 40

horse-power for every family in the state. In addition to this we are just learning how to utilize the energy of tides from which it is estimated that a half million horse-power may be developed on the coast of Maine.

There is extensive but as yet almost unused water-power on the many streams flowing from the lakes and swamps upon the large glaciated plateau between the St. Lawrence River system, the Atlantic Ocean and Hudson Bay.

The province of Quebec alone (see U. S. Con. Rep., Jan. 4, 1911) has, according to the estimate of the Canadian government, 17 million horse-power—Ontario 3 million and the entire Dominion 25 million. This is equal at 2 pounds of coal per horse-power hour, 8.76 tons per horse-power year (twenty-four hours per day, 365 days) to over 218 million tons of coal per year. It is nearly equal to the entire amount of artificial power developed in the United States. Less than 2 per cent of the water-power of Ontario and Quebec is now utilized.

New York state is about to inaugurate a series of state-owned reservoirs at the headquarters of some streams from which stored water will be released to be used many times as it passes through a succession of water wheels on its way down to navigable water levels.

Norway and Sweden have unusual water-power resources in their mountains, glacial lakes, glaciers, and snow fields. They have poor coal supply and in their forests a resource demanding power. It is but natural that they, like the Swiss who have similar conditions, should be leaders in water-power development, as shown by the fact that the Swiss are our leading water-power engineers and that Swedes are able to sell power at the astonishingly low rate of $5.35 per horse-power year (U. S. Con. Rep., Jan. 23, 1911).

Dry summer lands like the Mediterranean countries and California are greatly handicapped for water-power unless they happen to possess mountains where snow fields and glaciers melt in summer and furnish a flow when the rains do not come. Thus, the snow-fed waterfalls of the Alps are being rapidly put to use by the Italians who have no coal and the waterfalls of the Sierra Nevada mountains in California are already harnessed, power being carried sometimes as much as 200 miles to serve California

s, the water that produces it going on down to raise crops irrigation. Water-power is particularly valuable in these ntries because of the absence of coal, and it is being utilized dly. Thus Montenegro, is about to become possessed of new istries through the utilization of an 80,000 horse-power fall on River Tara. Similarly Bombay, India, soon expects to have a 00 horse-power supply from falls near three lakes at Lanavla, up in the Ghats 90 miles away.

ipan, also poor in coal, is turning to water-power of which Empire possesses from 1 to 2 million horse-power. Of this 000 are available in the vicinity of Tokyo, a city requiring 000 horse-power at present.

he Water-power Resources of the Torrid Zone.—The tropics, ly devoid of coal, have a compensating resource in the enors water-power which their districts of heavy rainfall afford. ca, a vast plateau, has rivers tumbling down to the sea in y cataracts, those of the Congo in west Africa rivalling gara in power, while engineers are already discussing the age of power from the falls of the Zambezi, 700 miles to gold mines of Johannesburg in the Transvaal, and the iond mines of Kimberley in Orange River Colony. From plateaus of Central America, streams fed by the trade wind develop many fine waterfalls, while from the Andean eaus streams go down to the interior of South America from plateaus, which give an unrivalled descent of from 6,000 to 00 feet. The plateaus of southern Brazil also result in many nsive waterfalls. Some of these along the coast are being , but the arrangement of streams causes most of the falls to the interior, as the great fall of Iguazu on the Parana.

lar Energy Direct.—There is small prospect of any extended being made of many of these remote water-powers, while are so many unused waterfalls, tidal bays, and coal seams e United States, Canada, Europe, and eastern Asia. It is ble also that none of these things will be fully utilized use of the progress that is being made in developing power tly from the rays of the sun—the source of all the energy al and waterfall and the chief cause of the prodigally powerinds which fitfully sweep around us with almost unthinkable mes of energy.

X

5. PETROLEUM

Petroleum—A New Source of Power.—It now seems probable that the development of hydro-electric plants and producer gas plants as well as the older types of steam engines may be checked for a time by the competition of cheap power developed by crude petroleum. There has been a sudden and great increase in the production of petroleum accompanied by increased knowledge as to means of utilizing it efficiently. New engines of the Diesel type developed in Germany promise to permit petroleum to replace even producer gas. Such a change may give somewhat cheaper power to a generation or two of men and cheat future generations out of the irreplaceable petroleum of which our supply is much more limited than of coal. Since nothing now in sight can replace it in many of its uses, particularly for lubrication, this new means of using petroleum is of questionable benefit to the race. This sudden new onslaught on petroleum as a source of power comes at the end of half a century during which this wonderful fluid has been of service in other capacities, chiefly as a source of light.

The Use of Petroleum.—Petroleum has helped greatly in spreading civilization over the world. All the world loves light, which is so necessary for the reading habit and the spread of civilization, and kerosene made from petroleum is, in every continent, the most common illuminant for the family lamp. For ages mankind had been depending upon vegetable and animal oils. Since remote times the lamps of south Europe have been lighted with refined olive oil. In northern Europe and America, whale oil was more popular, but by the middle of the nineteenth century the demand for this oil had become so great that the whales were well nigh exterminated and the discovery of abundant petroleum, and the art of using it came just in time to prevent a return to the gloom of the tallow candle. The heavier parts of this same petroleum oil the wheels of the world's machinery and the process of refining breaks it up into a surprising number of by-products.

The Origin of Petroleum.—Petroleum probably originates from animal remains buried in rocks, although theories differ. It collects, especially in porous sandstones, with water and

ural gas, the gas, being lightest, on the top, the oil next, . the water at the bottom. Small quantities come to the :ace in springs of water, and these oily springs have been ·wn for many centuries in the Russian oil fields. In western insylvania they were known for a century before the petroleum ıstry began, in some cases farmers being compelled to put oard across their springs to turn the oil aside so that their .le might drink. In 1853, a company began collecting the by absorbing it in blankets spread upon the ground, but the beginning of the industry dates from 1859, when an oil well

142.—Map showing general distribution of petroleum and natural gas elds of United States. (Day, U. S. Geol. Surv.) (From W. S. Tower.)

dug in the Allegheny Valley and 2,000 barrels were produced. :n the artesian bores broke the impervious caps that sealed oil sands the oil gushed from the earth, due to the great sure of the gas imprisoned with it. This sends the oil forth oda water blows itself from a bottle. This force, common etroleum fields, sometimes makes a well yield 600 or more els per hour.

he American Oil Fields.—The oldest American field runs ı southeastern New York, southwest through western ısylvania, southeastern Ohio, and the adjacent parts of

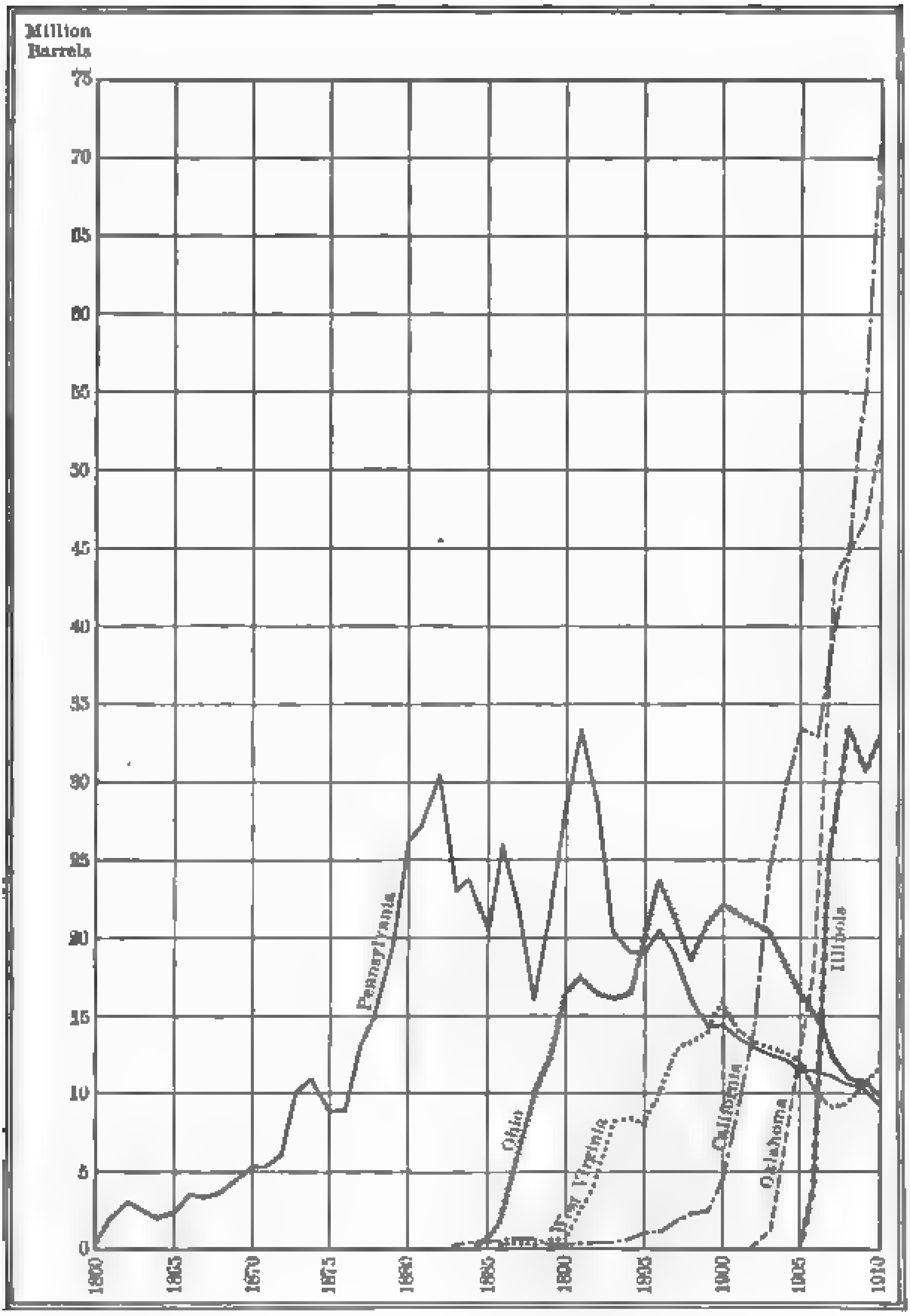


FIG. 143.—Petroleum production of leading states, 1860–1910 (barrels of 42 gallons). (U. S. Geol. Surv.) Petroleum is a meteoric industry.

st Virginia, a territory 160 miles long and from 25 to 40 miles width. The petroleum industry is a mushroom among ustries, so suddenly has it sprung up, so short is its life. thin 40 years after the discovery of the first well, this first d had 20,000 deep artesian wells and 4,000 miles of pipe line collect the oil in storage tanks and refineries. Large towns ring such suggestive names as Oil City, Olean, and Petrolia from small beginnings grown large, rich, and prosperous. oil prosperity tends to be short lived in any one place.

'he continuous discovery of new oil fields in many parts of the ld indicates, however, that oil may be an abundant material several generations to come. The ephemeral nature of the industry is well shown by the figures of production of differ- fields. Some characteristic outputs have been as follows llion barrels):

Pennsylvania	Texas	Louisiana	California
1861, 2 1891, 33 (max.) 1909, 9	1901, 4 1905, 28 1909, 9	1900 ... 1908, 5.7 1909, 3.1	1900, 4 1907, 37 1909, 54 1910, 65+

fluctuating ranks of the states in production is similarly ructive (million barrels):

1890	1900	1907	1909
Pa., 28 Ohio, 16	Ohio, 22 W. Va., 16 Pa., 13	Okl., 43 Cal., 39 Ill., 24 Tex., 12 Pa., 10	Cal., 54 Okl., 47 Ill., 30 W. Va., 10 Ohio, 10

he wild excitement and sudden spurt of fortune that follows striking of oil in the gushing wells gives an oil field more

feverish activity even than a gold field possesses. This fact, in combination with the quick rise, short life, quick decline of output, the emigration of population, the dilapidation and decay of temporary structures, makes it proper to call oil resources economic strong drink.

American prominence in oil production has been due to its first discovery and development here, but especially to the discovery of field after field. The second discovery of importance was the Ohio-Indiana field, which crosses the northern part of the boundary between these two states with its center in Lima, Ohio.

FIG. 144.—Oil well, derricks and pipes discharging crude petroleum into a pool containing many thousand barrels, Muskogee, Okla. (Standard Oil Co.)

The first decade of the twentieth century witnessed a number of discoveries. In the year 1901 the Beaumont field in southeastern Texas, only 18 miles from the Gulf of Mexico, at Port Arthur, produced large quantities of oil and gave well owners incomes of thousands and tens of thousands of dollars a day. Unfortunately the digging of many wells finally revealed the fact that the district (Spindle Top) covered about one-half of a square mile. Attention was next attracted to California, which in a short time surpassed in production all older states, to be in turn suddenly rivalled by the new fields, in Kansas, Oklahoma, and Illinois, while in northern Mexico a still more spectacular field was almost immediately discovered. The first California oil field, located in the southwestern part of the state, practically

derlies the city of Los Angeles where back yards bristled with lls, derricks, and some wells were even sunk in the Pacific to ike the oil-bearing rocks beneath the waters. The chief fields California are in Santa Barbara County in the Great Valley. lifornia oil is of especial value to that state because it is a ıvy oil good for fuel purposes in a region surprisingly devoid fuel.

The Russian and Mexican Fields.—All the American fields ;ether were at times distanced (before 1900) by the single great d of Russia. Evidences of petroleum exist from the Crimea the Black Sea eastward along both slopes of the Caucasus ountains and along the Persian frontier to the city of Merv, but ırly all the oil thus far produced in this large region has come m the small field around the town of Baku on the Apsheron insula which projects into the Caspian Sea near the end of the ucasus Mountain range. This has had a greater proportion naturally flowing wells than any other field, and several wells e yielded as much as a million gallons of oil per day for sev- l days in succession, a record that was unexcelled until the coveries of the Beaumont, Tex., field. These in turn were passed by the Mexican field in 1908.[1]

Other Foreign Fields.—Oil fields exist in widely scattered lo- ions. On the outer slopes of the Carpathian Mountains is second oil field of Europe. It lies in the Austrian province Galicia, and in Roumania. Promising prospecting is in gress in Persia and in Egypt. In Burma is one of the older fields which has given a steady yield but far inferior in quality Russia and the United States. The Dutch East Indies pro- e some oil in northern Sumatra, in eastern Java, and in

[1] On the fourth of July, 1908, the greatest oil well of the world was struck an Geronimo, on the Gulf of Mexico, 67 miles north of Tampico. When ck, the oil gushed so rapidly that before the fire in the boiler of the ne running the drilling machinery could be extinguished the flowing oil hed it and burst into a mass of flame which for two months burned 60,- to 75,000 barrels of oil per day with a flame from 800 to 1,400 feet in ht, and 40 to 75 feet in width, making light enough to be seen by ships miles at sea, and to permit a newspaper to be read 17 miles away. After loss of $3,000,000 the fire was put out, but the oil flowed so rapidly that ould not be carried away or put in tanks, and the English owners saved r oil only by confining it in a reservoir one-fourth of a mile long made by ing up earth embankments to keep the oil from flowing away like r. Even this well was later surpassed by the Potrero del Lano No. 4 near Tuxpan, Mexico, which yielded 160,000 barrels a day for some time.

Borneo, while Peru has, upon the shore of the Pacific near extreme western point of that country, a field yielding a he black oil of some value for illumination, but of great valu railroad and engine fuel in the industries and railroads of P a country having very meager supplies of coal. A more pr ising field is being developed upon the Peruvian plateau lake Titicaca. The Peruvian production in 1909 was 1 million tons.

The small production of Canada, Ontario Peninsula, now than half a million barrels, has dwindled 50 per cent. in ten y because there was but one field, but this is an exception in a ade when there has been phenomenal increase in oil product

PETROLEUM PRODUCTION MILLION BARRELS

	1900	1909	Per cent. world produc 1909
United States	63	182	61
Russia	75	65	22
Austria	5.7	14.9	5
Roumania	1.6	9.3	3
British India	1.0	6.6	2
Dutch East Indies	2.2	11.4	3
Japan	.8	1.8	..
World Production		285	

This table shows that the United States and Russia are the countries having large surplus for export.

The Transportation of Petroleum.—The fact that petrol products are used in almost all countries and exported fron few necessitates large transportation. The problem of hand this inflammable fuel has been difficult. At first, barrels used, then came iron tank railway cars and lastly pipe lines w the traffic is great. Iron pipes 3 to 6 inches in diameter are over long distances to connect oil fields with great markets ports of shipment. Thus the products of western Pennsylv were piped over the Alleghenies to New York, Philadelphia,

timore, and as oil development has gone westward the pipe s have been extended first to Indiana and lastly to Oklahoma, ence pipe lines reach eastward to Chicago and New York l southward to the Gulf of Mexico at Port Arthur. Oklahoma goes in both directions, but the greater part of it via the shorter s to the southern port. The recent large production of the ifornia fields has resulted in several pipe lines to the coast. Russians long used tank cars to transport their product over 600 miles of railway between the Caspian Sea and the Black ports of Batoum and Poti, whence the product has been pped in enormous quantities to European countries. A pipe has recently been established to handle a part of this traffic. natural accompaniment of the pipe line is the tank steamer, ding hundreds of thousands of gallons and loaded by merely ing the liquid flow in from the pipes. Such vessels connect h the pipe lines at Port Arthur, Texas, and carry crude petro- n to the refiners of England, France, and Spain, as well as to v York and Philadelphia. They also connect with the pipe s and tank cars at the Black Sea ports, while interior Russia upplied by tank steamers which ply upon the Caspian and the navigable Volga River.

'he transportation equipment of a single corporation, the ndard Oil Company, makes an impressive list.

8,000	miles trunk pipe lines
75,000	miles feeder pipe lines from wells
	Storage for 82 million barrels crude oil
10,000	tank cars in America
2,000	tank cars abroad
60	bulk ss for ocean carrying
12	for foreign coasting trades
150	ss and barges in America
3,000	tank stations in America
5,000	tank stations elsewhere.

(Duncan, *Principles of Industrial Management*, p. 59.)

etroleum as a Source of Power.—The first great use of petro- n was for illuminating oil and then for lubrication, but with opening of the twentieth century it has rapidly increased in as a source of power. In three different ways it is now an

important source of power. The first to be developed was gasoline, a petroleum product so volatile that it gives fuel for the gas engines that have made possible the large development of the automobile, the motor boat, and the motor cycle. The gasoline engine is also much used for small industrial purposes.

The second use of petroleum as a source of power is for ordinary boiler fuel.

The fact that petroleum is the richest of all fuels makes it of great advantage in steamships where space is always the very life of the enterprise. Oil tanks take up less space than coal bunkers and the crew can be reduced because flowing liquid replaces the labor of coal passers. The boilers in numerous small vessels in the United States Navy have for several years been heated with crude oil and in December, 1911, it was decided to adopt oil as the fuel for new battleships. The use of crude petroleum as fuel in merchant ships is becoming more general and some corporations agree to distribute the product throughout the world to steamship and other users, by carrying it in tank steamers, some of their vessels staying in seas west of the Suez Canal and getting the supply at Batoum, Port Arthur, or Philadelphia, while other vessels avoid the Suez tolls by staying in eastern seas and getting their supply in Burmah, Sumatra and Java.

Where coal is scarce and oil is plentiful it is utilized as locomotive fuel. This was the practice in Peru even before 1900 and recent new discoveries of heavy oil are extending its use there. Five-sixths of all the locomotives of Roumania are oil burners, but southwestern United States affords the greatest example of its use. The great oil fields of Oklahoma and California are at the ends of a region where coal is scarce. In southern California locomotive coal at times cost $11 per ton and the cheap oil of the new fields was quickly utilized and now drives the locomotives on 17,000 miles of railway between the Gulf of Mexico, Oklahoma, Utah, and California.

One-third of the Russian supply is used at home as fuel.

The third and newest use of petroleum as a source of power is in the German invention of the Diesel engine, an internal combustion (gas engine) which has the great advantage (in cost) of being able to use the crude petroleum as it comes from the earth.

ı so efficient that a gallon of oil costing from two cents to cents will develop 15 horse-power hours. This invention nises to make oil a great power fuel while the present cheap asts. In Germany this engine is also being used to develop er from tar oil derived from the tar produced by the by-prod- coke ovens and the producer gas plants.

atural Gas.—Natural gas, the most volatile of the petroleum lucts, is the best and most convenient of all fuels, the cheapest most convenient of all sources of power. It separates itself ı the oil as cream separates from milk but it accompanies the n practically all fields. It has for many centuries burned at :revices of the rocks on the Russian oil fields where for ages the worshippers of Persia have made pilgrimages. The greater of this gas, which is richer in heat than that manufactured o much expense in most cities, has been largely wasted, ıg to heedlessness of man, and to the inherent difficulties of lling new problems that must be handled by legislation. In), the gas thus going to waste from oil wells in the United es was probably worth at city prices over half a million ırs a day. In the American oil fields this gas has been of great industrial importance in the iron and glass industries, oiler fuel and as city gas. It has been piped to Pittsburg, to do, Cleveland and Columbus, Ohio, to Ft. Wayne and anapolis, Indiana, to Detroit, Mich., and many smaller ıs throughout the Pennsylvania, Ohio, Indiana, and Okla- a oil fields. Recently it was brought to Baltimore. Most rtunately the life of the gas well is short and the supply hausted in a few decades, but it furnishes an astonishingly p fuel while it lasts. It is often sold as low as ten cents per sand cubic feet. This resource has been the fourth element aking western Pennsylvania more liberally supplied with fuel . any other place in the world. In that region a thick forest red hills which were underlaid with the magnificent coal ısits of the Appalachian field, while further down was crude oleum, and the natural gas that drove it spurting from the :es in the rocks. The gas from this field is now about ex- ıted, the forest is practically gone, the oil output has greatly ned, and the coal is being rapidly used up, and scenes of lation face the traveller. No wonder the American people

are beginning to consider the question of the conservation of natural resources.

Refining of Petroleum.—Crude petroleum is very complex chemically and every year more and more commercial products are being separated from it. The process of refining consists of distillation. The thick, black crude oil is put in a large tank and heated so that one product after another becomes volatilized and passes off, like steam from a kettle, to be caught and condensed. Some of the first products are very volatile oils used chiefly in dissolving rubber in rubber manufacturing. Then come naphtha and gasoline which are used in the gasoline engines of motor boats and automobiles. Kerosene, the great illuminant, is the most important oil of all. The heavier oils that come next are used for fuel and lubricants, for which purpose they are superior to either animal or vegetable oils because they do not become gummy or adhesive so soon. A thick black residue remains. Of this there are two types, one containing much paraffin, the product of oil said to have a paraffin base, the other containing much asphaltum, and hence said to have an asphalt base. Further processes of refining these residues produce paraffin for candles, paraffin oils, tar for roofing, and finally, a hard, black coke, amounting in some cases to 6 per cent. of the whole amount of crude oil. Each product is capable of separation into others by redistillation, some of the products being vaseline and many other ointments and drugs, so that altogether the modern refinery sells in addition to kerosene several hundred by-products.

Our Foreign Trade in Petroleum.—The American trade in petroleum products is as wide as the world. Our oil makes better illuminating oil than that of Russia, and is sent, in the crude form, to some of the more important countries, while in the form of kerosene or refined petroleum for lamps it is distributed more universally to the nations of the world than any other product of American export. It goes alike to Greenland and New Zealand, Norway and Madagascar, to the tribesmen in Italian East Africa, and to the Italian in the home country, to the Spaniard in Spain, and the Spanish-speaking Mestiza or half-breeds of the Philippines. The Chinaman, who regards light as a most prized luxury, has taken such quantities of American refined oil that this

nmodity alone makes up the bulk of all American exports to t country. The ordinary 5-gallon cans of American refined are distributed throughout the interior of China in places ere the face of the white man has never been seen. The vier lubricating oils are not so universally used by all people, they are sent from the United States to almost every country ere railroads exist or steam engines run. We exported in 0 about a billion gallons of illuminating oil and a sixth as ch of lubricating oil and of crude oil.

sphalt and Wax.—These products are not fundamentals of nufacture like coal, iron, petroleum, and natural gas, but their irrence with petroleum is the reason for presenting them here. hough a solid asphalt is a common accompaniment of the oil ls it is supposed to be crude petroleum oxidized. It, therefore, n occurs where the oil has flowed to the surface and partly lified. Its existence often points out the existence of the oil. chief use is for paving streets and it is produced commercially he cantons of Neufchâtel and Vaud in Switzerland and also ome places in Germany, France, and Italy. Algiers sends e to England, and the Mexican oil field was known for its nalt for many years before the oil fields were worked. All e are, however, deposits of minor importance. The best of sphalt deposits are near the mouth of the Orinoco River in ezuela and on the adjacent British island of Trinidad. Here ie famous asphalt lake, which at the present time produces greater part of the world's commercial asphalt because of great ease with which the product can be gathered and ped. The lake is less than a mile from the seashore, and men can walk across the surface, and dig up the asphalt, h is sufficiently viscous to slowly replace itself within a few s. Cable ways with travelling buckets transfer it easily the lake to the holds of the ships which carry it in full cargoes ort 123,000 tons, 1909) to New York, Philadelphia, New ns, Liverpool, Buenos Ayres, or any of the world's com-ial ports where this much prized paving material is in nd.

okerite, or mineral wax, a material somewhat resembling ffin, is found in several oil fields and makes the brightest l candles. It exists in great quantities in the Russian oil

regions, but practically all the world's supply is gathered in Galicia, where there are even richer deposits along with a labor supply more abundant than in any other existing oil field.

In some parts of the world, particularly New South Wales and southern Scotland, paraffin oils exist in oily shales from which the oil is extracted and refined. This industry was begun in a small way in Great Britain in 1850, but the product there and in Australia has never been large enough to prevent a very great import of oil from the United States and Russia.

6. OTHER SOURCES OF POWER

Fortunately man does not have to depend for power upon wood, coal, oil, natural gas, or waterfalls. These are but a very small fraction of a veritable fury of power manifestations in the midst of which man lives. The ultimate sources of this power are two:

First: The cosmic force of gravitation and planetary momentum that gives us the tides. These we have thus far used but little, although methods for its utilization have recently been perfected.

Second: The chief source of all our power is the sun, whose energy is stored in wood and fossil fuels, but whose chief manifestation is in the wind. This result of the unequal heating of the earth's surface develops such tremendous energy that in the work of carrying the earth's waters it uses power of which the water-power resources as man sees them are but a small fraction of 1 per cent. In passing over the surface of the sea the wind raises the waves which have eaten away continents. In the mere rising and falling 2 feet three times per minute the waves exert on a strip 100 feet wide 6,000 horse-power per mile. This power man has not yet utilized.

The direct force of the wind has for centuries driven man's ships, his grain mills, and his pumps. Wind mills by tens of thousands are to-day pumping water on American and other farms. Wind power is well suited for this kind of work, which does not have to be done at any particular time. The grain can be stored in a hopper and ground when the wind blows and the water is stored in tanks until wanted. If necessity drove

to it there is no reason to think the inventors and engineers ıld not in a generation or two devise some effective means of ng our heavy work with wind and wave power.

All other sources of power pale beside the great source— direct rays of the sun which are calculated to hurl into 9,000 ıare miles of Egypt enough power to replace all the engines l waterwheels in the world. Three different types of mechan- ı have utilized this power to a small extent. The success ıuch power development to the point of superiority to existing ver sources offers interesting speculation as to where would natural seats of Empire when the best sources of power were hin the zone of 200 or 400 mile-power transmission from cloud- deserts.

Alcohol is, however, nearer to us from the mechanical stand- nt. It can be produced from henequin pulp, corn stalks, atoes, and a great variety of vegetable materials. We ady know how to use it as a rival of gasoline and kerosene l it is extensively used for those purposes in Germany, which no petroleum and much potato land. Alcohol as a source power permits us to go on indefinitely, because it depends ın agriculture, the enduring industry. The alcohol tank ımer coming from a distillery on a trade wind shore beside pic yam or cane fields tilled by Chinese emigrants could prob- give us a surprisingly close duplicate for many of the prod- s of petroleum. At this present time fuel alcohol made from ar cane in Cuba, suitable for automobiles and other gas en- es, costs per horse-power lower about 60% as much as gasoline 20c. per gallon.

The prediction that our coal will never all be mined is there- not altogether fantastic.

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rsons interested in the mineral industries have unusual sources of mation in

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CHAPTER XI

THE FOREST INDUSTRIES AND PAPER

The Uses of Wood.—Man cannot get along without wood. It s been useful in all stages of civilization and the more civiliza-n advances the greater is the number of services it renders us. serves as fuel for the savage's camp fire, it makes the wagon which roving tribesman carries his family and goods, and when settles down to agriculture he uses wood for his plow, for his use, for the barns for his cattle, and for the fences that limit land and keep his animals from wandering away. It rendered same services in the making of house, barn, fence, and house-d fuel throughout Colonial America, and to-day its use even fuel is as great in the United States as ever before. World nmerce is served by the millions of trees that go each year into bed of the railway as ties, while the lordly conifer has for turies been the mast of the ship. In this day of great move-nt of goods, surprising quantities of wood are used for barrels packing boxes, a single Philadelphia soap factory using for purpose five carloads per week. Each day some inventor ls a substitute for wood in one of its uses, but other inventors corresponding new uses for it, so that our dependence upon increasing day by day. It has even become essential to the ading of knowledge, for practically all our books and maga-s are printed on paper made of wood pulp.

he American Forests and Their Destruction.—America is richest of all continents in useful wood. Through much of history our people have had to fight the forests, which came n to the shore of the Atlantic so that the first settlers landed eath its shade. The first effort of the new colonist was cted against the forest, which he worked laboriously to clear y before he could plant a crop. He then had to struggle years with the stumps before he could have a smooth field to v his food. Decade after decade, through the seventeenth,

eighteenth, and the middle part of the nineteenth centuries, the occupation of the country east of the Mississippi went steadily forward, accompanied by the destruction of the forest to make room for the plow. In this process millions of fine oaks have been rolled into piles and burned to get rid of them. The price of lumber was practically the cost of getting it out, and for fir wood and some other wood products this still continues to b true in many localities. Throughout this period of most activ forest clearing the necessary lumber was usually made in littl saw mills on local streams where the water wheel drove a bi upright saw up and down and ripped off the boards one at a tim for the man who brought his logs to the mill. Recently, gre improvements have been made in the manufacture of logs int useful lumber, the circular saw has replaced the upright sa and in some cases the rapid double-cutting band saw has replac the circular saw, especially for the large logs in the western mill

The Rise in the Price of Lumber.—About the year 19(America began to reach the end of an epoch in the lumber suppl For fifty years the price of lumber had been rising in Europ while we in America had been cutting down the forests, wasti the wood, using lumber prodigally and letting the forest fire ru almost unheeded, to the great destruction of the young trees th should make the lumber of the future. Suddenly, there was revival of prosperity, an increase in lumber demand and lumb price. Saw-mill operators moving from the North and East beg to purchase timber lands and timber leases in the South and Wes The owners of timber land began to realize that before long would be more scarce and they would not sell their timber lar at the old nominal price of $1 to $2.50 per thousand feet boa measure[1] in the standing trees. They preferred to wait for higher price in the future. Thus the price of timber land ar lumber rose. The reasons for this anticipated scarcity we that we had large areas importing lumber from other state Such older states as Ohio and Indiana that had long been suppl ing part of the supply of the treeless Mississippi Valley wi thousands of towns and hundreds of thousands of farms sudden came to the end of their lumber supply and also began to impo heavily from distant places. At the same time northern ar

[1] Board foot = 1 foot long, 1 foot wide, 1 inch thick.

stern lumber regions began to show signs of exhaustion, and nber operators from New England, New York, Pennsylvania, d Wisconsin began to buy timber lands in the South and West, ving up the price of timber lands by their competition for m.

The Location of the Lumber Industry.—Lumber is a product pending upon forests and favorable conditions of transportation market. It can only be made from a large log, very heavy and icult to transport. This log must be carried sometimes for es from the stump upon which it grew to the saw mill, and the vy boards carried thence to market and sold. In the past the e of lumber has usually been much less than a cent a pound, hat lumber making for the market has always been dependent n very favorable conditions of transportation, often depend- in part at least upon water transportation. Owing to the ater difficulty of handling the big log than the smaller board, saw mills are situated as closely as possible to the place where trees grow, and if wagons must be used to carry the logs the l is often portable and moves about the woods sawing the logs a few acres in each place, thus minimizing the log hauling. arge saw mill is usually found only where the logs can be ted down a river or brought in by rail, so that it can draw its ply for many years from the large territory drained by the r and its branches.

s to the forest, it will grow from the heart of the tropics to edge of the Arctic far beyond the grain line, if there is a lerate rainfall, evenly distributed throughout the year. nted moisture, no soil is too poor, too sandy, or too rocky e tree can once catch hold with its roots. So great is this er of tree life that a good timber tree often stands on the of a cliff fastened by roots that have wedged themselves in crevices which they have penetrated in the search for food. Within the forest the trees vary greatly in their suitability for ber, most of which is made from a few species that are espe- y adapted for lumber uses by form and quality. The shade s commonly used along city streets of America and Europe the broad-leaved deciduous trees. These handsome species poor timber trees because they grow with many crooks in r trunks and a great proportion of the wood of the trees in the

branches. The cone bearers are better timber trees bec: they have a large, straight trunk with small branches. T can also thrive in lower temperatures and poorer soils. A result our familiar broad-leaved trees do not furnish over a qu: of the lumber used in the United States or in Europe.

The Forest Regions of the United States.—The natural fc region of the United States comprises practically all the cou along the eastern coast to the mouth of the Rio Grande, from Atlantic to eastern Texas, Kansas, and Illinois, and cer

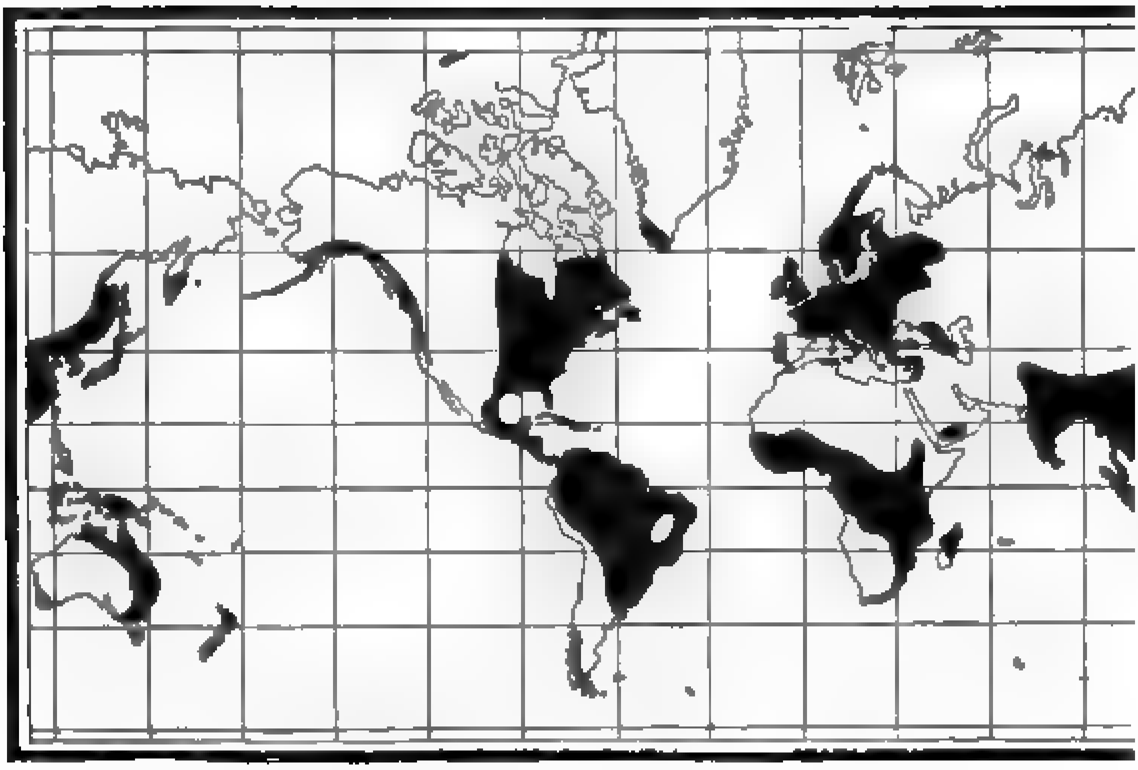


Fig. 145.—Arid regions of world (rainfall less than 20 inches per year sho white. Forests grow on the mountains of arid regions and on plains at lat. 55°. (U. S. Geol. Surv.)

Minnesota, from Lake Michigan to the Gulf of Mexico; a l area in the higher regions of the Rocky Mountains; and the Pa forests on the Sierra Nevada and Coast ranges. It is too for tree growth on the lower lands of the Rocky Mountain reg the Great Basin and the Great Plains, and the Prairie fires by Indians to improve the pastures are supposed to have l down the forest in large areas of the Mississippi Valley w trees now thrive when man gives them a chance. Parts of Shenandoah Valley of Virginia and West Virginia are for same reason said to have been devoid of forest at the tim settlement.

consideration of our lumber industry the forests of ited States may be divided into seven districts:

New England and Adirondack Forest.—First of these is the upper New England and Adirondack forest

—Natural forest regions of North America. (U. S. Forest Service)

ing a highland with a climate rather too cold for satis- agriculture of nineteenth century type. Much of this untry is impossible of plowing and tilling because it was

made rocky, swampy and sandy by the work of the overriding ice in the glacial epoch.[1] But its rocky and sandy soils can, if properly cared for, give us crops of wood indefinitely. This lumber district being easy of logging and near to cities was the first in the United States to be largely developed. The succession of rivers from the Hudson to the Saint Croix at eastern Maine furnish the water ways by which the logs have for decades been floated down with the spring freshets from the highlands to the manufacturing towns of the lower land near the sea. Thus,

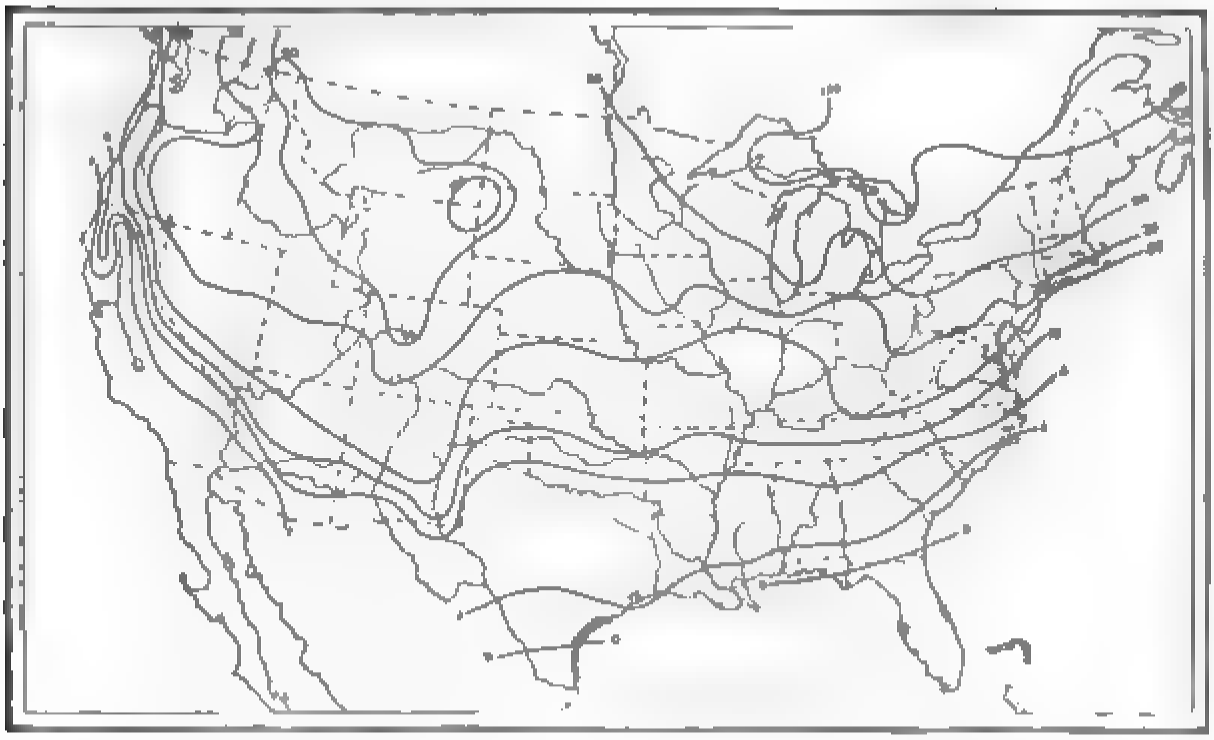


Fig. 147.—Mean annual snowfall in inches, for United States. The snowfall on the Sierra Nevada and Rocky Mts. is much greater than shown on this chart. (After Henry.) (From W. S. Tower.) (Snow is a great lumbering factor.)

Bangor, on the Penobscot, with its many saw mills, makes yearly many millions of feet of lumber at a place convenient for the loading of schooners that carry it to Boston, New York, the West Indies, Brazil, Europe, or even South Africa. The cold winter and heavy snow of this northeastern highland are an essential factor in the lumber industry because the swamps and rocks impassable by wagons in summer, are covered by the deep snows of winter so that teams are able to sled the logs out to the stream bank where the melting of the snow in spring furnishes the freshets

[1] Thus Hamilton County, New York, in the center of the Adirondacks has but three persons to the square mile, although two railroads give access

carry the logs downward to the mills.[1] For many years ıber lands were valuable only when within easy hauling disıce of some stream, but the recent rise of price of lumber and ently invented machinery has made it possible for temporary lways and traction engines with sled trains to carry logs many les from previously unvalued forests to the stream banks.

The most important timber tree of this forest region is the ite pine, a good timber tree yielding one of the very best of

148.—The value of snow to the Northern Lumber Industry. Thief River Falls, Minn. (U. S. Forest Service.)

ds. It is prized for its lightness, strength, durability, freedom ı warping, cracking, or shrinking, and the ease with which ın be worked. So widely prized has it been that it is now ıming exhausted, and the output of it is actually declining. ıce, an inferior wood, is second in importance, and hemlock, ill more inferior wood, is third. The broad-leafed trees ıding the maples, beeches, birches, chestnut and oak form

[1] he log drive of 1910 on the Connecticut river consisted of 45 million ɔoard measure and gave employment to 500 teams and 1,000 men.

but a small part of the forest growth in this and the next for district.

The Forests of the Great Lakes.—The second forest disti is that around the Great Lakes, which is climatically and dustrially a sort of separated western half of the New Y and New England field. Similar glaciers overrode the states Michigan, Wisconsin, and Minnesota, leaving in their north parts similar sandy, rocky, and swampy areas. The liken to the east is completed by the predominance of the white pi the spruce and the hemlock, while the lumbering operations carried on with the assistance of the snow, which in the reg between Lakes Superior and Michigan attains a greater de than in any other part of the United States and enables the m astonishing loads to be taken out over a land which is in summer utterly impassable for any kind of terrestrial vehi The lumber industry of this district shows the westward devel ment that has accompanied the advance of the American pec across the continent.

Lumbering began in the lower peninsula of Michigan, t went to the upper peninsula, then Wisconsin succeeded Michi as the leading state, and as the forests were cut here, Minnes succeeded Wisconsin as the leading lumber state. Minnesot turn has been surpassed by the rapidly rising lumber distr in the south and on the Pacific coast. The exhaustion of white pine especially has been the impetus to make the lum men emigrate to new fields.

The logging enterprizes of the Upper Lakes have been a l in a peculiar industrial chain. The one-crop farming that characterized the grain-producing farms of the Mississi Valley has made a great demand for labor at harvest time that a farm having upon it one man in winter suddenly nee two or three more at harvest time. The total result wa demand for tens of thousands of men for a few weeks in a loca which needed them no more until the next season. For m years thousands of men passed the winter in the logging car at the Upper Lake forests, felling trees and hauling logs to stream bank. With the spring thaw, many of the choppers r upon the log rafts down the Mississippi to St. Louis or N Orleans, and in late May began the summer's work as harv

in wheat fields of Texas, and followed the advancing harseason northward through Oklahoma and into the wheat of Kansas. They also harvested hay and oats in that and Nebraska through July and early August, and then took harvesting of spring wheat in South Dakota, southern sota, the Red River Valley of the North, and Manitoba.

.—Log slide to the river. Priest River National Forest, Idaho. (U. S. Forest Service.)

followed the threshers through the frost of the autumn, ith the coming of winter rode eastward on the grain-carry-ilroads to take up their axes once more in the lumber camps.

alachian Highlands Forest.—The third forest district is of the Appalachian Highlands, reaching from southern York to the extreme northern parts of Georgia and Alabama. plateau, becoming higher as it goes south and reaching its

maximum elevation in North Carolina, extends the temperature of New England far into the south and with it the trees of New England. Some hemlock is found in western Carolina, central West Virginia has 2,400 square miles of spruce, some white pine, and some hemlock, while hemlock has long been a standard timber from the Pennsylvania mountains. In this Appalachian district the steepness of the mountains and the small amount of snow makes impossible the extended use of sleds as in the New England, Adirondack and Great Lake forests, and the logs are moved to the mills on wagons or, in some cases, on chutes of logs or steel down which the logs slide from precipitous hills to a temporary railway in the valley below. The timber has been almost entirely exhausted from parts of this region. Carloads of lumber are now regularly shipped into Pennsylvania districts from which twenty-five years ago it was sent out by the trainload.

Hardwood Forests.—The fourth lumber district is the middle region of hardwoods from New York to Alabama and from Alabama to the Ozarks and the lower Great Lakes. Pine trees grow naturally upon the sandy Atlantic plain, the evergreen spruce, pines, and hemlocks hold the top of the Appalachians, but between these two on the lower slopes of the Appalachians and the hilly country leading up to it on both the eastern and western slopes is a large area where the forest is made up of the broad-leaved[1] trees, the oak, the hickory, the chestnut, the tulip, the black walnut, and to a lesser degree the ash and bass wood classed as hard woods by the forest service. This belt reaches from southern New York through northern and western New Jersey, the central parts of Maryland, Virginia, and North

[1] *Commercial Woods as Classified by the Forest Service*

Soft Woods	Hard Woods	
Pines	Oak	Cottonwood
Firs	Maple	Ash
Hemlock	Poplar	Hickory
Spruce	Gum	Walnut
Cypress	Chestnut	Sycamore
Redwood	Beech	Cherry
Cedar	Birch	
Larch	Basswood	
Tamarack	Elm	

ırolina, to northern Georgia, thence around the southern and stern slopes of the Appalachians to Ohio and thence westırd to the open prairies and southward and southwestward rough Kentucky, Tennessee, southern Missouri, northern kansas, and into the Ozarks. This is the region from which e American supply of these hardwood timbers has chiefly come, hough they are produced to a lesser extent in both northern and ıthern forests. Lumbering on a large scale was done earlier the eastern part of this hardwood district than in the western, that at the present time West Virginia, Kentucky, Tennes-, and Arkansas are the states of greatest production. Chatıooga is a great lumber market, while Memphis is the greatest rdwood market in the world. Oak, chestnut, and hickory are leading woods, and it is the district producing the greatest ıounts of tulip, poplar, and black walnut.

Southern Pine Forests.—The fifth lumber district is that of southern pines. New England has relatively declined while south has come forward rapidly since 1890, with greatly inased shipments of the wood of the long-leafed pine, called rd pine, or yellow pine, Georgia pine or Carolina pine. e strength and hardness of this pine makes it much prized flooring and the building of railway cars, wainscoting and ıny other uses and in 1910 it furnished 35 per cent. of all the nber cut in the United States. Other pine trees also grow in s belt, particularly the short-leaved or old field pine, one of the test growing trees in America, which, between 1860 and 1900, ered many abandoned corn and tobacco fields in Maryland, tern Virginia and North Carolina with a growth large enough the saw mill. These two pines make an almost continuous est from Long Branch, New Jersey, to Austin, Texas, the ırt-leaved being found in the extremes and the long-leaved in middle part between the mouth of the Chesapeake and ıisiana. The short-leaf pine forests which cover much of tern Texas are now being rapidly converted into lumber, but warm moist climate makes this one of the best of sections the trees to replace themselves if they are properly cared for. Much of this southern country is sandy and level, some of it ıtly rolling, but none of it is even rugged. A very large proporn of it is yet in forests. The lumbering is much easier than in

New England or the Appalachian district. About the year 190C the ox-cart, which has been the chief dependence in logging opera- tions, began to be replaced by temporary railroads which are pu' through the woods about 2,000 feet apart so that a donkey engin winding a cable 1,000 feet long can draw logs from any part o the woods to the side of the railroad track where they are loade and carried away to the mill or to the bank of some stream upo which they are at times floated 60 or 70 miles down toward th sea for manufacture and shipment by water to the lumbe markets of New York, Boston, Philadelphia, and other easter cities. This wood is also prized in Europe and the combine coastwise and export trade make large shipments from the port of Mobile, Alabama; Pensacola, Fla.; Brunswick and Savannal Ga.; Charleston, S. C.; New Berne, N. C.; and Norfolk, Va while the new town of Gulfport, Miss., is actually the greates lumber-shipping point in the world. Vast quantities of souther pine are also sent by rail into the Ohio and Mississippi valley:

Another important timber tree in the southern field is th cypress, which is one of the few trees that will grow in a swam where its roots must be under water. In past ages these tree have fallen over and been covered by the peat and swam waters and perfectly preserved, so that houses may now b finished with the beautiful fossil cypress taken out of swamps i the Atlantic coastal plain from Florida to New Jersey. Cypres lumber is much prized for shingles and the interior work of house and is much substituted for white pine.

The shifting source of cypress well illustrates the growin shortage of lumber, and the reasons for its rise in price. Norfol used to be the great cypress market, but the comparative ex haustion of the Dismal Swamp supply caused Florida to succee Norfolk, whereas scarcity in Florida has been followed by th rise of New Orleans as the chief market for the product c this swamp forest tree.

The Western Mississippi Valley and the Rocky Mountai Forests.—The central part of the Mississippi Valley north of th Ozark Mountains and west of Indiana was almost treeless whe occupied by the homesteaders in the second and third quarte of the nineteenth century. Exception should be made of th moist lowlands along the stream where the scattered growth c

›ad-leaf trees was of great value to the early settlers. At the rth the humidity in the glacial swamps and the lakes had preved forests west of the source of the Mississippi, and at the ıth, the Gulf rains had extended the forests over east Texas d the Ozarks. A timberless area bounded by the west boundary Indiana, the Rocky Mountains, Canada, and the Rio Grande d one oasis of forest on the small highland where the Black lls, with a greater rainfall, supported a rather inferior tree ›wth.

The heavy timber supply of these treeless states, which has ›tened the scarcity of American timber, comes chiefly from the eat Lakes, the South, the Pacific slope and, to a lesser extent, m the Rocky Mountain district. Here, owing to the slight nfall of low elevations, forests grow only in high elevations, ticularly in the South, but the lessened heat and evaporation ke the area of the forest increase in Idaho and Montana. e percentage of forest area is comparatively small in New xico, but it has many more square miles of forest than has w Hampshire. There are even several hundred square miles fine forest upon the plateaus of northeastern and central izona, and there are large extensions of this same plateau est in the mountains of northern Mexico through which new lroads under American management are now being built ween the Rio Grande and the Gulf of California.

Sometimes the Rocky Mountain forests are upon plateaus d slopes at the head of steep walled canyons through which s will not float, and where the prospect of permanent settlent and traffic are too small to warrant the building of lroads. From these seemingly inaccessible places lumber and s are brought out by flumes or troughs through which a eam of water flows and pushes the lumber down a gentle line often miles in length over territory utterly impassable any other means of transportation.

Forests of the Pacific Slope.—The seventh forest district the United States and the finest in the world is that near the cific coast. In many of the eastern forests we have only m four to ten thousand board feet of lumber per acre, but ge areas in California, Oregon, and Washington have a hundred usand feet to the acre, and some small groves of the so-called

big trees will yield from 1 to 5,000,000 feet to the acre. T forest belt begins about latitude 35° in California, wher occupies the Sierra Nevada and Coast ranges, but low rain causes the great valley of that state lying between these mo tains to be treeless, as are the lowlands farther south. northern California, parts of Oregon, and central Washing

FIG. 150.—V-shaped board flume floating sawed lumber out of impass Rocky Mts. Canyon, Wyoming. At the right a creek adds to the water ply. (U. S. Forest Service.)

the forests cover not only both mountain ranges, but the rat high and rough valleys between. The second range of mount sharply limits the rainfall so that, except upon the higher ran there is no forest in the Great Basin between the east fron the Sierras and the Wasatch Mountains of Utah nor betw the Cascade Mountains of west central Washington and Ore and the mountains of Idaho.

he even climate, a good rainfall, and freedom from wind-
ms permit the trees of the Pacific forests to grow for ages
attain great size, as is shown by the well-known big trees
California. But commercially more important than these
it giants are large areas of forest in all three of the Pacific
s where there is a thick stand of redwood, Oregon pine or

. 151.—Relief map of California. The treeless central plain is conspicuous, e state is largely mountainous. An explanation of the importance of her t resources. (From W. S. Tower.)

glas fir trees 4, 5, 6, 7, and often 8 to 10 feet in diameter
straight trunks 100 and even more feet in length. It is
ult work to get these huge logs to the saw mill, and for this
n much fine timber is wasted. As it is utterly impossible
ul them on an ordinary wagon, they are sometimes dragged
nkey engines or long teams of oxen over a road bed paved
small logs, oftener they are taken on temporary railways
sometimes they are allowed to slide by gravity down log

chutes. The lumber is manufactured in the largest and m perfect lumber mills in the United States, some of them us every particle of the log that is brought to their wonder machinery. A typical mill makes match sticks, but it also s shingles and lumber produced from the rough portions of logs, while the sawdust and bark feed the engine fires. Sail

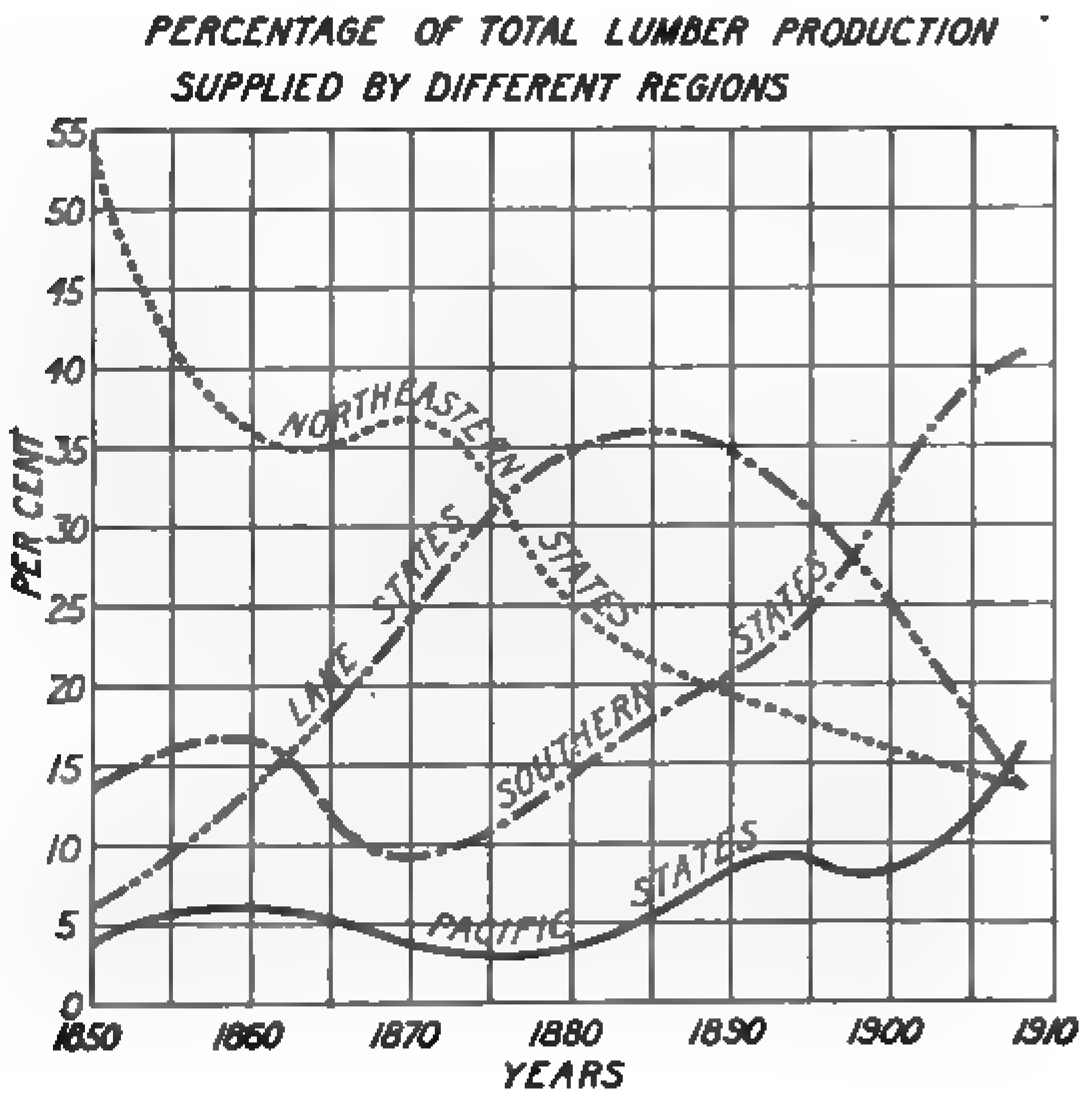
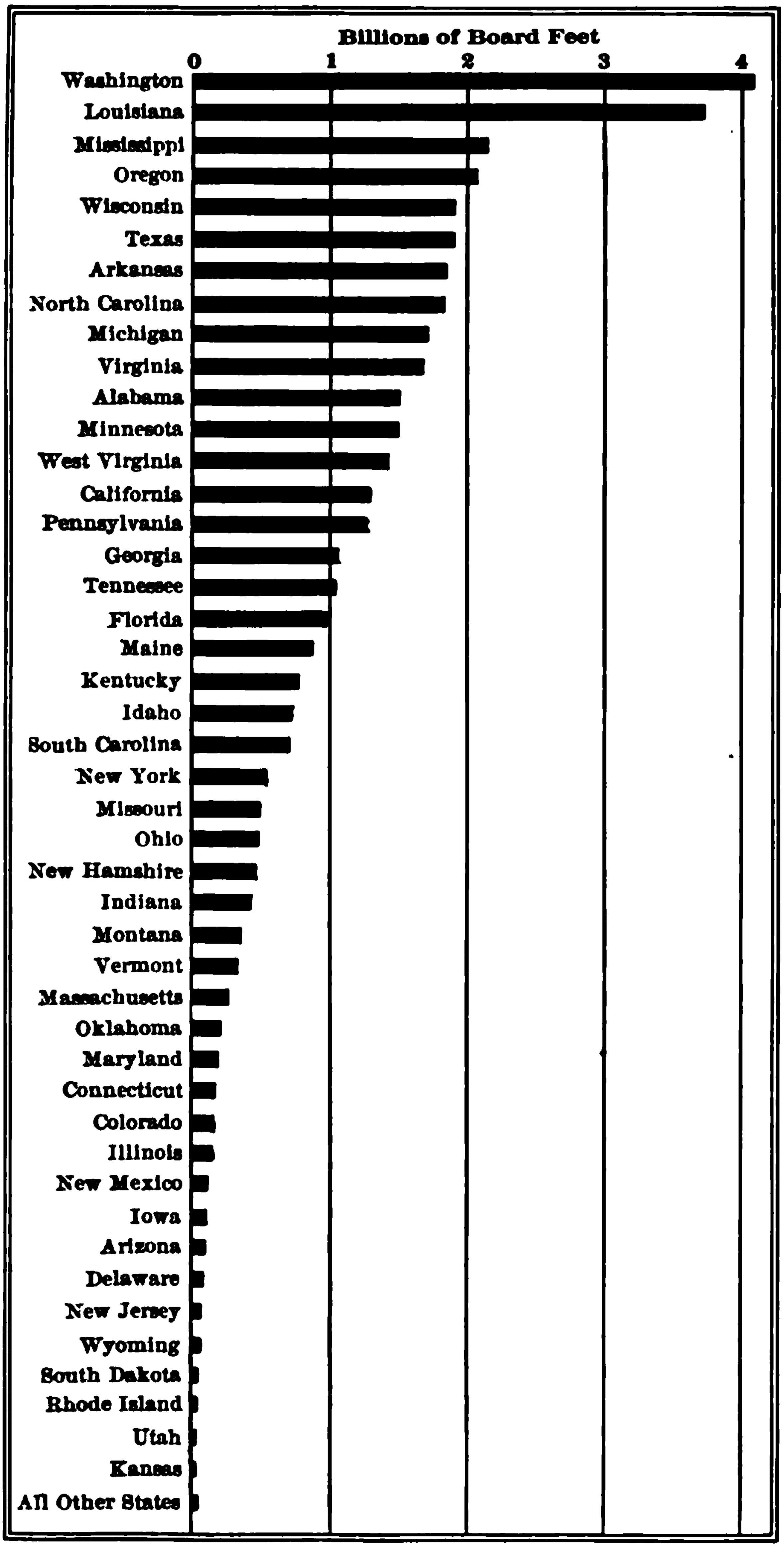


FIG. 152.—United States lumber production.

vessels load at Seattle and Tacoma, Washington, Vancouv B. C., Eureka and Humbolt in California to carry this m excellent timber to markets of South America, Australia, Jap South Africa, and even to England, France, and Germany voyage much longer than half the distance around the world.

The increased price of lumber in the United States has ma possible the carriage of Pacific coast lumber across the contin



IG. 153.—Lumber production by states, 1910. (U. S. Forest Service.)

to Chicago and even to New York, and it has become an important article of freight eastward upon the transcontinental railways.

The Shifting Lumber Supply.—The changes in price, the exhaustion of local supplies and the competition of the different lumber fields gives a great variety of lumber to the eastern United States. In the vicinity of Philadelphia, the joists (floor supports), which used to be of hemlock, are now partly supplied by old field pine grown on abandoned corn and tobacco fields in eastern Virginia. If the outside is of wood it will mostly be made of redwood or fir from the Pacific coast in place of

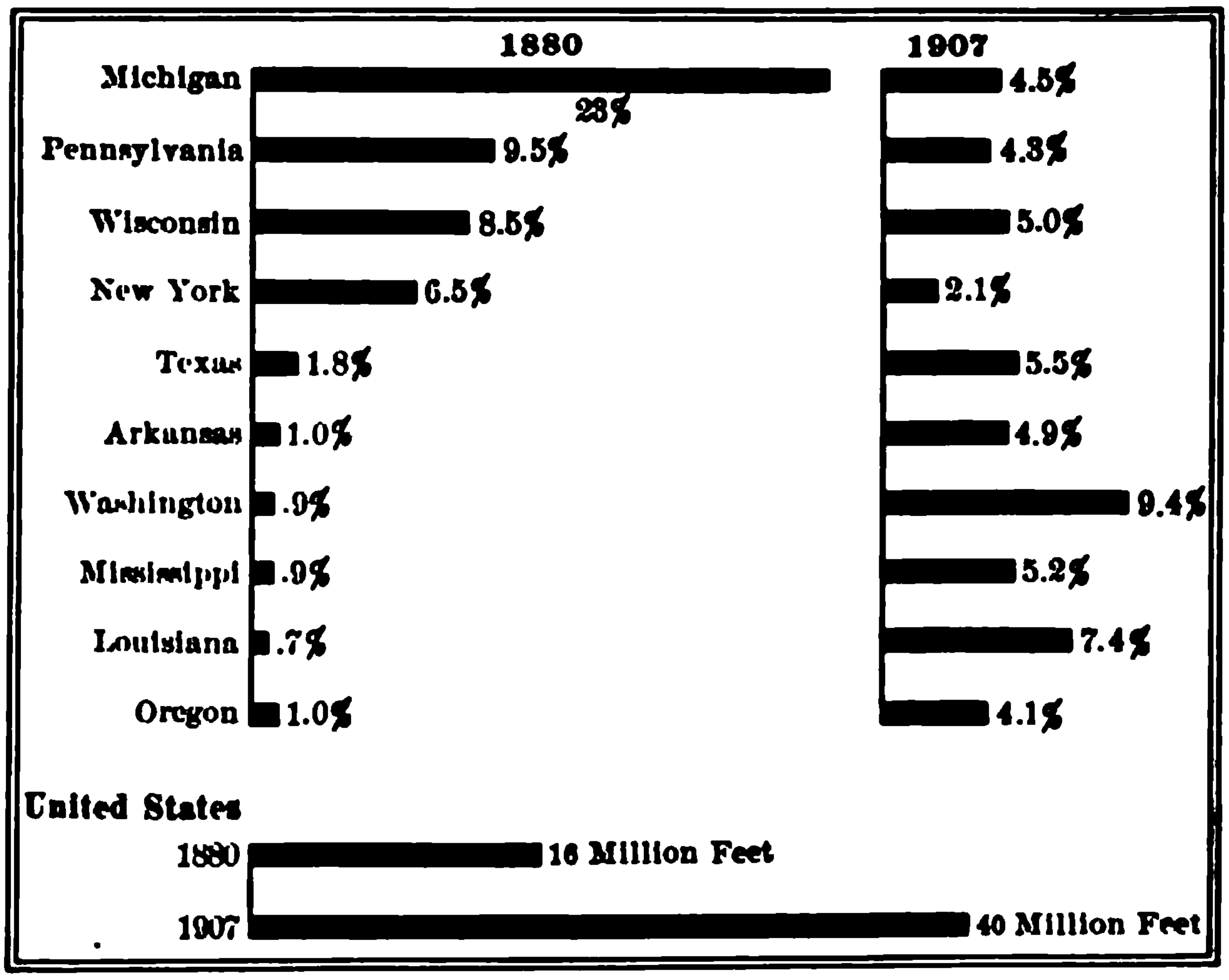
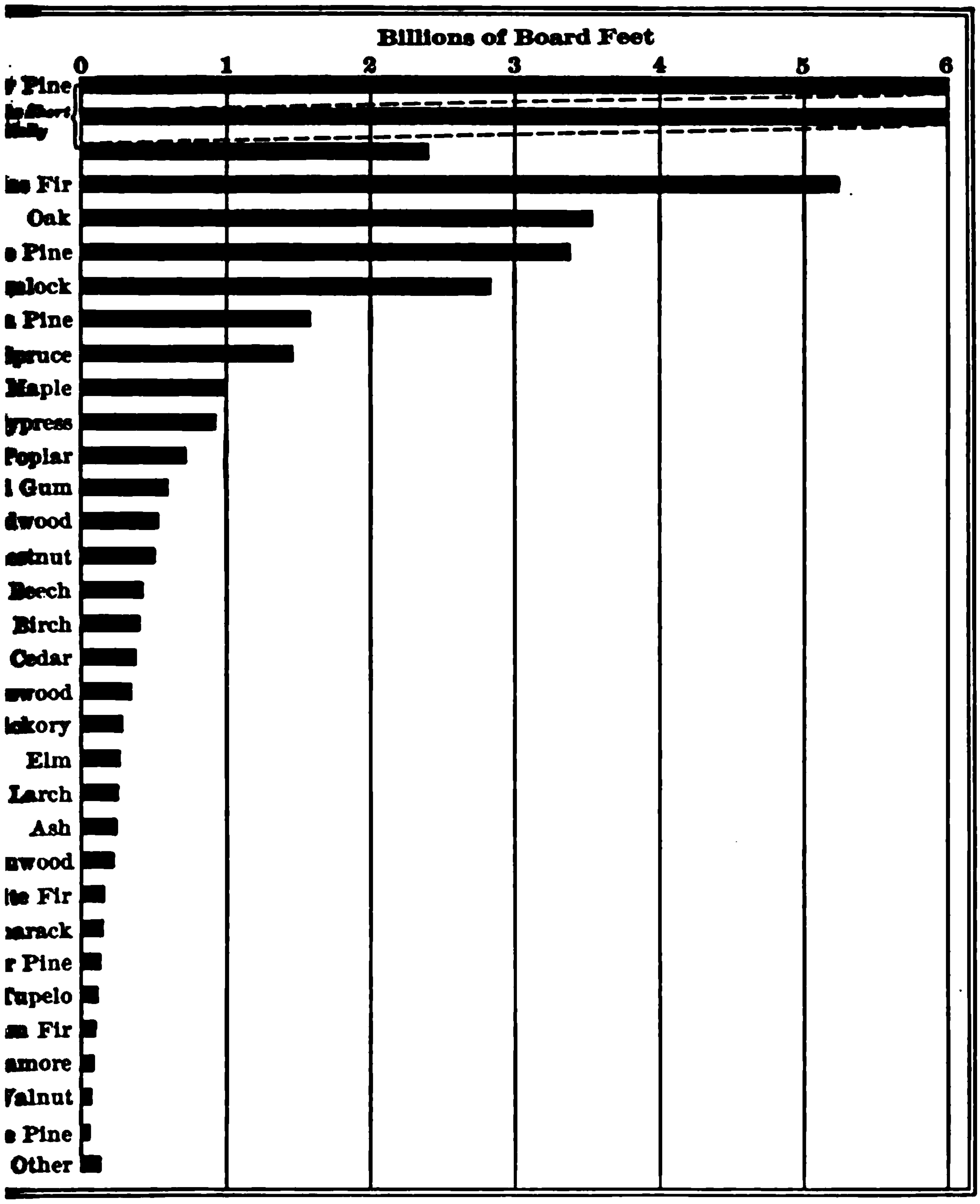


FIG. 154.—The shifting lumber supply as shown by percentage of output by states is 1880 and 1907. (U. S. Forest Service.)

white pine from northern forests. For interior finishing, cypress, Georgia pine and West Virginia chestnut have replaced Maine pine. The flooring is the hard pine of the South, the shingles are fir from the state of Washington, which has replaced the cedar from the swamps of New Jersey, or cypress from the Dismal Swamp of Virginia. Nearly all American cities have an equally wide supply and have had equal shifts in its source.

Examination of the production chart shows some surprising facts such as Louisiana outranking any northern state, Virginia leading California, and Maine being eighteenth in the whole

d with a smaller output than any one of eight southern Our increasing dependence upon wood, also our new



55.—Lumber production by varieties, 1910. (U. S. Forest Service.)

s to use it are well shown by the transformation in the industry[1] from a bit of luxury in furniture to a material

rmerly veneer making was confined to a few hardwoods selected for f grain and used as an exterior finish for high-grade furniture and work. With the improvement of veneer machinery and methods of here has developed a large demand for veneers cut from cheap woods l for packing boxes, berry cups, fruit baskets, veneer barrels, drawer , filling in three-ply lumber, glass backing, and novelties, such as ishes, wooden plates, and fancy confectionery packages.

ccount of the constantly increasing price of hardwood lumber used

for packing boxes. Half a billion feet of lumber are used as veneer each year in the United States; it is rapidly increasing, and eighteen different woods were used to the extent of over 10 million feet each in 1910, the principal one being red gum, a wood that had long been wasted because it could not be split for firewood, and when sawed it warped excessively and soon rotted. In veneer work its non-splitting tendency is a positive advantage.

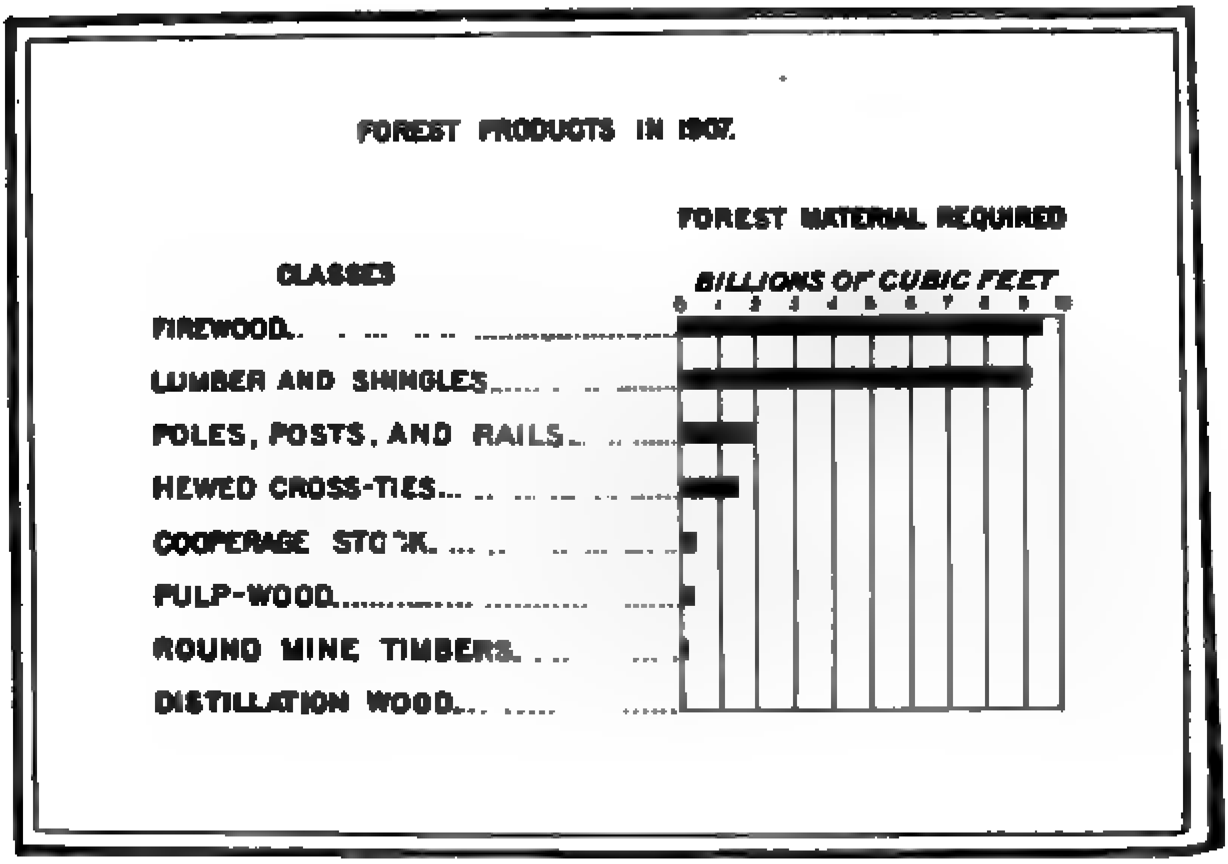


FIG. 156.—Lumber uses.

Canadian Forests.—Four of the forest belts of the United States touch and extend across the Canadian boundary. The Pacific and Rocky Mountain forests combine in Canada, extend northward through British Columbia and on to the Yukon, a vast region crossed as yet by but a single railroad, the Canadian Pacific near the Canadian boundary, so that most of it is unsettled and much of it is even unexplored by any but the unscientific

for making furniture, fixtures, and cabinets, built-up lumber, which is usually made of three-ply veneer, is being extensively substituted. For manufacturing this built-up material, it is possible to use woods which heretofore have been but rarely used, owing to their tendency to twist and warp when sawed into lumber."—Bureau of Forestry Report.

ıpper and prospector. It contains, along with some land good r agriculture, many forests that await the building of railroads get the product upon the world's market. The treeless belt the Mississippi Valley goes northward through Canada until latitude 60 the moisture conditions for forest growth are again ınd and there is a connection between the Rocky Mountain rests and the forest region north of the Great Lakes in a subctic forest belt 200 to 300 miles in width. The whole of the untry from near Winnipeg to the Atlantic was originally a est of which but a fraction has been cleared for settlement in e region between Lakes Erie, Ontario, and Lower Huron, and the St. Lawrence Valley. North of this small inhabited belt one of the great forest reserves of the future reaching from ar Lake Winnipeg to the mouth of the St. Lawrence and from ıdson Bay to Georgian Bay, the Ottawa River and almost to e banks of the St. Lawrence itself. Much of it is upland, it well sprinkled with lakes and marshes, and is practically untled, except by a few Indians, fur trappers, and summer fishnen. A railroad is being built across it from the south end of ke Winnipeg to Quebec, and branch lines have been built rthward from the Canadian Pacific to reach silver and nickel nes in the newly discovered Algoma district north of Lake perior, otherwise this great forest is yet without industry save nbering on its southern edge. For this the Ottawa River es a good outlet and the city of Ottawa is an important lumber ırket. There has already been great injury by far-reaching est fires and the railroad increases this danger. The cold nate of the great Canadian forest area north of the land of ms gives a slow growth to the trees.

A continuation of the New England forests occupies most of Canadian territory between the St. Lawrence and the Atlantic, l lumber is an important export from both Quebec and New unswick, which latter greatly resemble the state of Maine in nate, topography, agriculture and in the importance which nber and fishing assume.

Forests cover much of Newfoundland, and wood products are only plant products exported from that cold, foggy, and ırsely peopled island.

Alaskan Forests.—The forests of Alaska are a continuation

of those of British Columbia. In the southern part of Alaska, especially on the rather narrow Pacific slope, there is a heavy rainfall and a considerable area of evergreen forests. In the interior of Alaska there is also forest growth along most of the streams. This is true of nearly all the lower courses of the Yukon and its branches and the wood thus supplied has been of great aid in the operation of steam boats and hunting for gold along those streams. But little of this timber of interior Alaska is large enough for the saw mill, its rate of growth is slow and it has had serious fire injury. Fortunately small trees are as suitable for paper making as large trees.

Comparison of European and American Timber Conditions.—Europe, having four times as many people as the United States and Canada, and having been much longer occupied by a large population, has very different forest conditions. The American settlers found a continent covered with the forest growth of centuries which they have cleared to get at the earth in desirable localities and have elsewhere cut recklessly and with no regard to the future. While a scarcity threatens the United States, Europe has long felt it in the form of high prices, and is raising timber as carefully as she raises breadstuff. European timber consumption per capita is about one-sixth or one-seventh that of the United States, which is over 400 feet board measure per year.

FIG. 157.—An example of French economy. An 11-pound cut flower basket for parcel post shipment made of split cane and requiring but a fraction of the material necessary for a wooden box. (U. S. Consular Bureau.)

This European economy involves many practices unknown in new forested countries. The American people annually destroy tens of millions of barrels and packing boxes, after they have been used but once. These barrels and boxes are made of sawed lumber with all the waste this involves. In Europe packages are often used repeatedly and are usually baskets made of round or

lit twigs of willow which is grown for the purpose. The trees e planted in wet ground and repeatedly cut off when 5 or 6 ›t high so that the stubby trunk with its great load of long igs yields repeated harvests of basket material, being many nes as productive in this respect as American trees that are ce cut to have boards made of the trunk only. Reeds re-nbling bamboos are also planted in the south of France and her European localities for package material. Frame houses ve been built by hundreds of thousands all over the United ates and Canada, while many people in central Germany ver in all their lives saw a frame house. It is decidedly eaper there to build one of brick, stone, or plastering put upon vooden framework. This framework is often of unsawed poles ıde from small trees, rather than the sawed material from large es as in America. Reeds from the stream bank often replace Germany the plastering lath used in America. This house ıde of reeds, poles, and plaster illustrates Europe's economy of od. In forested mountain districts the European often uses od as shown by the well-known Swiss chalet. This form of use seems to be a mountain institution, as it exists also in ıthern Asia Minor and on the southern slope of the Himalayas.

European Timber Markets and Exporters.—All Europe north the Mediterranean slopes is naturally a forest country. In gland, however, only 4 per cent. of the land remains in forest. e needs of tillage have not caused such complete clearance the North Central Plain which reaches from northwestern ınce through north Germany and central Russia to the Urals. ere are considerable areas of sand suited to little but pine est. Holland 10 per cent. forest, Belgium 17 per cent. forest, 1 well-tilled little Denmark 4.8 per cent. forest have put their d to the plow and must import nearly all their timber of which ; four countries in Europe have a surplus, namely, Norway, eden, Russia, and Austro-Hungary. Norway and Sweden , like New England and Canada, glaciated, mountainous, and ›opulous, with a comparatively small proportion of their land ›d for anything but the growth of trees or forests which assume ery important place in the foreign trade of these countries. Norway 75 per cent. of the land is unproductive, 21.5 per cent. n forest and but 3.5 per cent. is under cultivation, and forest

products make up over 25 per cent. of the exports. In S
52.2 per cent. of the area is in forest and the proportion
population engaged in the manufacture of wood prod
nearly as great as that engaged in railroad work in the
States. As in America north of latitude 60, the forests of (
extend east and west across the continent, so in Europe the
of Norway and Sweden in the same latitude are continue
ward across Finland and north Russia to the Urals and
across Siberia to the Pacific. Hence the Baltic and Wh
ports of Russia have an important timber export.

The fourth European lumber export district is western
containing on the mountain ranges of the eastern Alps
forest, largely oak, which yields a comparatively small qu
of export timber.

FOREST AREA

	Percentage of area in forests	Approximate area of forest lands, square miles	Tota in s m
United States	.289	860,000	2,973
New Hampshire	.676	5,628	8
Washington State	.514	34,000	66
California	.20	31,250	155
United Kingdom	.041	5,000	121
England	.052	2,680	50
Russia (European)	.409	761,772	1,862
France	.18	36,000	207
German Empire	.24	54,000	208
Switzerland	.21	3,355	15
Italy	.139	15,437	110
Austria	.346	41,100	115
Holland	.10	1,264	12
Denmark	.048	750	15
Norway	.21	26,900	128
Sweden	.522	90,241	172
Japanese Empire including Formosa.	.165	29,000	175

Forestry and Timber Supply in Central and Northern Europe. -The scarcity of timber, that has caused the European nations ɔ preserve their forests and produce lumber under a forestry ystem, has usually caused the central governments themselves ɔ go into the lumber business. Nearly all the governments wn forests and care for them as part of their administration. s a result France has 18 per cent. of her area covered with ›rests, Germany 24 per cent. and Switzerland 21 per cent., and ι populous Saxony the forest area rises to 25 per cent. During ıe disturbances of the French Revolution, forests were cut from ›me of the mountains of France so that the earth, exposed to the 'osion of rainfall, was washed away to the destruction both of ıe mountain soils and the valleys below, upon which the rocky ›rth was piled. After the end of the Napoleonic Wars, steps ›re promptly taken to replant these areas wherever possible. The French government now owns and operates 6 million res (over one-fourth the forest of France) at a cost of ninety-'e cents and a profit of $1.75 per acre per year.[1] Within a ntury an area of shifting sand dunes and marshes in the south-'st of France twice as large as the state of Delaware has been rned into a profitable pine forest yielding rosin, tar, pitch, rpentine, and other products. These are made from small ›es which are bled to death in the process, and the trunks sent England to serve as mine props. This thinning promotes the ›wth into sawlogs of the trees that remain.

Scientific Forestry in Europe.—It is to Europe that we must to see forests well managed and producing their maximum out-t. There we can learn to make our own forests permanently et our needs. In densely peopled localities the trees are often ›nted as thickly as hills of corn in the United States, which is ›ut 4 feet apart. When the trees are 1 1/2 to 2 1/2 inches in meter they are cut for use as bean poles, hop poles, fence ings, etc., while the later thinnings furnish poles for firewood l many other uses, including part of the framework of the ster house. At the end of fifty or one hundred years, after ny thinnings, the forest contains only big trees that can be 'n into boards and building timber, after which the forest is lanted, to go through the same cycle of harvests. Many

[1] *Science*, Aug. 20, 1909.

FIG. 158.—German fence made of forest thinnings. Uprights are first thinning 1 1/2-2 1/2 inches in diameter, round. Cross pieces are second thinning split. Posts are larger round pieces. No saw or slab waste.

FIG. 159.—Cornfield made by the Indians' method of deadening the trees and letting them stand. Slopes of Blue Ridge, Mitchell, Co., N. C. (U. S. Forest Service.)

erman and Swedish towns own adjacent forests which are ırefully managed and furnish the towns with a large part of their venues. There are several different systems of handling rests in Europe each suiting some particular kind of forest or ndition of marketing the product. Sometimes they take out ıly the largest trees, thus giving the small ones a chance to grow. ne fact rather discouraging for America has been shown by ıropean experience. The large trees make wood faster than ıall ones, so that it takes a forest many decades to reach its riod of maximum production, and the scientific forestry of est Europe does not meet the needs. Even France, Germany, ıd Switzerland with their relatively large percentage of well-anaged forests do not supply their own needs..

The importance of forests and forestry is shown in the ountains of Switzerland and the Black Forest district of south ermany, where wood carving is an important industry of the asants in the winter season, and their wooden toys and curios e exported throughout the western world. In the beech-owing districts of the Chiltern Hills, northwest of London, ,000 families are engaged in chair making, working mostly their own houses, where parts of chairs are made to be assem-ed in the towns, of which High Wycombe is the most important.

The Forest Policy of the United States.—The European perience of timber scarcity, soil loss, tree planting, and forestry s at last been heeded to some extent by the United States, pecially since the rising price of lumber, beginning about 1900, s called the attention of all classes to the promised scarcity of nber. Our national government has begun a national forest licy by setting apart as national forests parts of the govern-ent land having trees upon it and not fit for agriculture. ıe map of the national forests shows that they comprise large eas in the west, being nearly five times as large as New England, d comprising about one-fifth of the standing timber of the ıited States. The national forests of California alone cover ,000 square miles, an area more than two-thirds as great as ew England. Oregon and Washington together have the same ıount and Idaho and Montana each have two-thirds as much—e total area of national forests in these five states being greater an that of the United Kingdom and Belgium combined. With

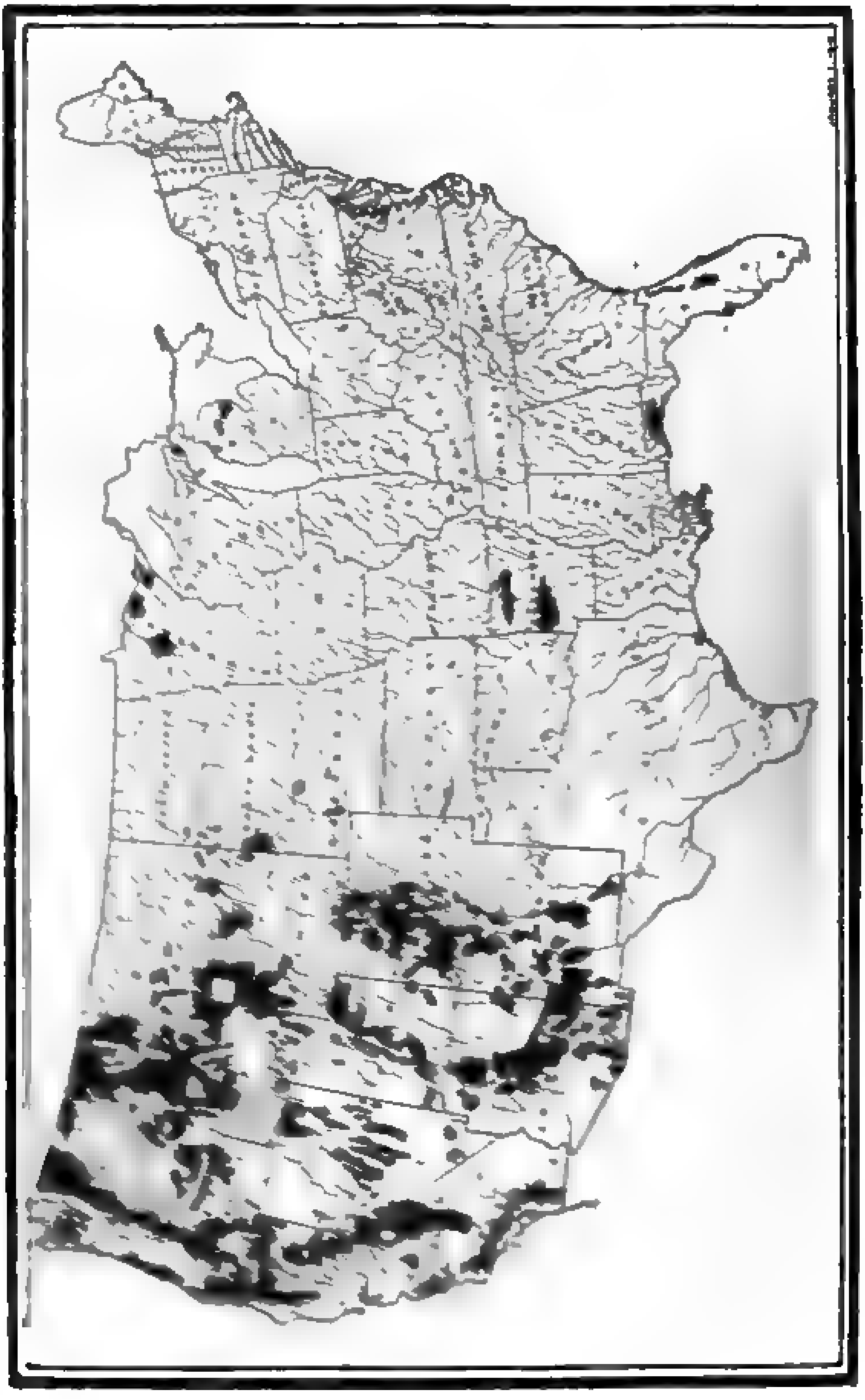


FIG. 160.—Map showing distribution of the National Forests (1910).

ood care our national forests can be made to produce vast mounts in future decades. Many of our states also own timber ands, but these are chiefly burnt over stump lands which have verted to the state because no one will pay the taxes. Our rest policy is as yet in its infancy and its chief function thus far as been the merely preventive one of fire protection, which after l is the most important thing in all forestry.

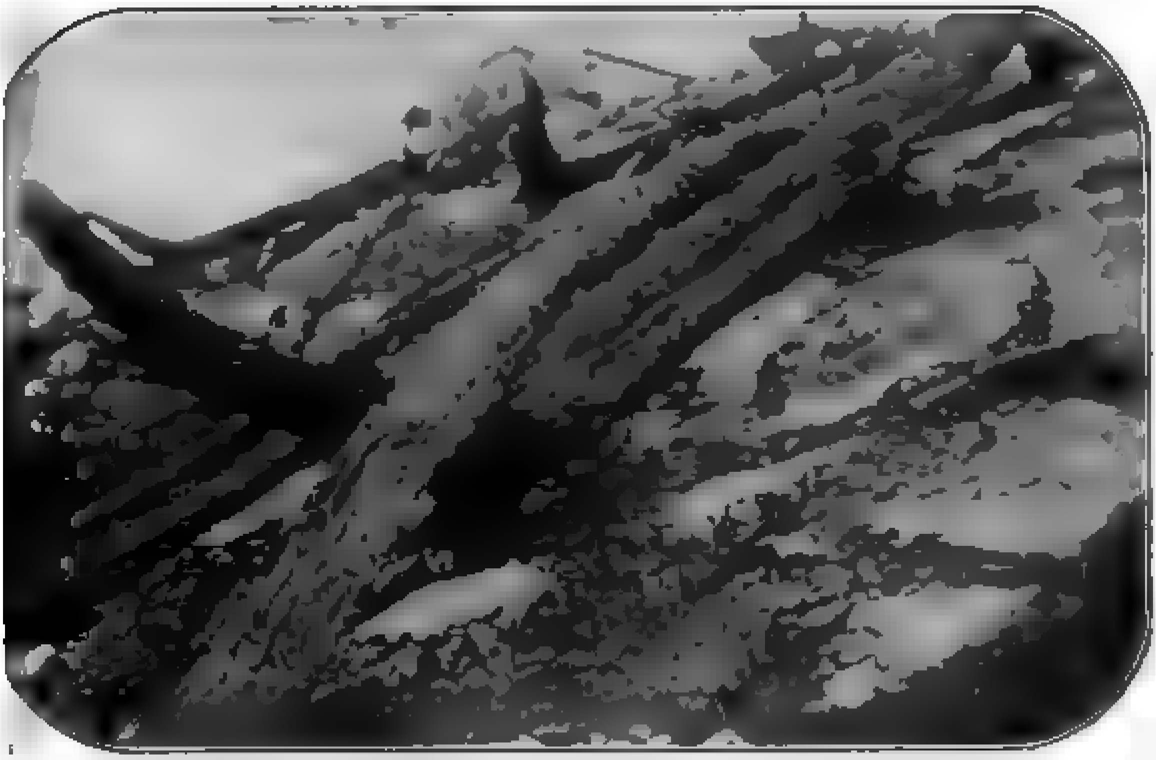


FIG. 161.—"After Man the Desert." These rocks were covered with trees, ots and black soil before the forest fire. Mt. Tabor, Rutland Co., Vt. (U. S. rest Service.)

Numerous forces are promoting forestry in the United States— e high price of lumber, the sentiment for conservation of natural sources and lastly the irrigators of land and those interested river navigation. These latter, although their interests as plied to the same stream are diametrically opposed, want ater in the streams and this is promoted by the natural storage the leaf mold beneath the mountain forest and by the earth hich the gripping roots preserve upon the mountain's rocky amework. This lack of the protection to the earth, our greatest source, has wrought fearful destruction in old lands.

We may expect a steadily increasing output of lumber from

national forests chiefly by the sale of standing trees to saw-mill owners.

The Forests of Mediterranean Countries.—In Europe, as in America, the coniferous trees comprise the northern forests while the oak comes from lower latitudes, growing in Spain, Italy, Hungary, and the Balkan Peninsula. In Servia, the oak trees on the high lands comprising most of that country furnish in their acorns one of the leading crops—harvested by swine.

There are practically no forest resources of importance along the southern or western shores of the Mediterranean and the dry summer of Spain, Portugal, Italy, Greece, and Turkey limits tree growth to the mountains with their greater rainfall, and leaves all these countries with an insufficient supply of lumber. The houses are almost invariably built of earth materials, mostly stone and plaster and, as these countries are barren of coal, and populous with poor people, many of the inhabitants suffer keenly from cold in the winter season.

Italy, having, like France, lost good lands from unwise deforestation, has also been planting forests. The soil destruction in these European countries is as nothing in comparison to that which has occurred in north Africa, Palestine, Syria, and Asia Minor, where many districts that were fertile and populous in Roman times have been reduced to deserts through neglect, forest fires, overpasturing, and reckless tree cutting by ill-governed peoples. It is said that there are more Roman ruins west of the Jordan than in all the rest of the world together, and where there were once populous cities, there is now no support for tillage and a very considerable territory east of Antioch which was populous when conquered by Pompey and ruled by Cæsar is said to have the soil so thoroughly washed away that there is nothing but bare rocks. Some of this desolation has probably been caused by the changes in the rainfall but forest denudation has been a more certain factor.

Cork.—Cork, the most important forest export of south Europe, is the tough outer bark of a kind of oak growing upon the highlands of Portugal, Spain, southern France, and the mountain ranges of north Africa running through Morocco, Tunis, and Algeria. The bark can be stripped repeatedly from the trees at intervals of a few years. The chief export comes from Spain

nd Portugal and a smaller amount from Algiers and Morocco. 'he cork oak grows without cultivation on rough mountainous ınd and it covers large areas in the northeastern part of Spain ear and upon the Pyrenees Mountains in Catalonia where the est quality of cork is produced. An increasing output shows ıe importance of the industry in this district—18,000 metric uintals in 1819, 36,000 in 1842, 62,000 in 1865, and over 85,000 one-third of the Spanish product at present. It is also largely 'own in the province of Andalusia and Estremaduro in south-estern Spain and in the adjacent parts of Portugal. The panish cork exports exceed $7,000,000 and the cork forests over 1,300 square miles (840,000 acres) in Spain and also in ortugal. In Algeria the area is 50 per cent. greater and the ıtput is 50 per cent. less. Some cork is also grown in the south France and the introduction of the tree into the United States ıows that we have large areas suited to it if we choose to so se our land. Because of its high value and easy transport by ıck animals this is an ideal crop for isolate and almost inaccess-le locations.

Japan's Forest Industries.—Japan is a country which from cessity takes excellent care of its forests. Because of the rocky ıture of the country and heavy rainfall, forests cover a large ırtion of the country, much larger than in mountainous Switzer-nd. Having a meager coal supply, the forests have up to a re-nt time furnished all the fuel as well as building material of a nse population, now 50 million people on 112,000 square miles.[1] ıe United Kingdom with 45 million people on 121,000 square les has used up practically all her forests and has long been porting from the United States, Canada, Norway, Sweden, d Russia. Since her industrial Revolution Japan has opened previously unused oak forests in her little used north island, zo, but this does not seem to meet her growing needs, for in ent years lumber import into Japan from the United States s begun. It is probable, however, that Asia will supply most Japan's timber. The immediate cause of the Russo-Japanese ar was a dispute over certain timber concessions along the lu River between Manchuria and Korea. Manchuria and

[1] Excluding cold Yezo. Total Japan 147,655 sqare miles. Total Empire),540.

Korea have extensive forests under Japanese control, but most of them will be inaccessible until American methods of lumbering shall be introduced and new railroads built. In bamboo, lacquer, and camphor Japan has three forest products that well illustrate the genius of oriental people. The bamboo is probably the most important Japanese tree. It is planted and cared for like a field crop and fills a multitude of uses. It is said that the ingenious Japanese can build with it an entire house—framework, floor, walls, and roof—while its large joints serve as buckets and other utensils in great variety, the young shoots serve as food. The lacquer, that beautiful varnish which we see on the glossy lacquer ware, is made from the sap of the lacquer tree. The camphor is a kind of resin from a tree which grows throughout most of the Japanese Empire, but the trees have been so vigorously cut that the greater part of the world's supply now comes from the Japanese colony of Formosa. In the effort to raise revenue camphor has been made a national monopoly and wars of extermination have been waged against the savages of east Formosa, so that the camphor gatherers could stay with safety in the forests. Camphor trees grow to great size, and a single specimen will keep a couple of men at work for a year or two, chopping it to bits, from which the camphor is soaked in boiling water and finally secured by distillation.

The Japanese government regulates this monopoly with systematic care, making provision for its perpetuity by adequate planting of young trees. But the monopoly totters before scientific agriculture and industrial chemistry. The chemists have found that there is more camphor in the leaves and twigs than in the trunk. As the leaves grow annually and can be harvested without injury, it is manifest folly to wait fifty or a hundred years for a tree to grow and then reduce it to shavings. The average worked camphor trees are 12 feet in diameter and yield 3 tons of camphor, but are a quarter of a mile apart. Scientific agriculture shows the camphor tree to be hardy in many countries including Florida. The U. S. Department of Agriculture introduced specimens into Orange County in 1881. In thirty years one of them had attained a diameter of 4 feet, was perfectly hardy and the ground beneath was a mass of camphor seedlings. The seed has been planted like oats, the young

lants harvested with reaper of special design and fine camphor distilled from the resulting "hay" of camphor tops.[1]

. 162.—Forestry. Bamboo grove in central China where temperature falls to 20° F. (Photo F. M. Meyer, explorer, U. S. Dept. Agr.)

Numerous successful groves attest our ability to grow useful rieties of bamboo in the United States when we appreciate : need and profit of so doing.

Ref.: *Rural New Yorker*, 1911; *Harper's Magazine*, 1912; *Scottish Geo-phical Magazine*, Vol. 20.

Forests in China.—The Chinese forest situation is far inferior to that of Japan. In some districts her dense population long ago used all the forests and often dug up the roots with frightful results in floods and denudation. In many sections of the country, her people raise a small amount of fuel for domestic use in the form of the stalks of a coarse millet, while considerable parts of the Empire have been irreparably injured by the cutting off of the forests and washing of rocky mountain earth over the fields in the erstwhile fertile valleys. A scientific forest policy is undoubtedly one of the most pressing needs of the new government, and one of the most difficult for it to bring about. Meanwhile the new era of railways will bring much lumber from the less populous parts of the Chinese highlands, especially to the south of the Yangtse. At the present time there is a considerable and growing import of lumber from the United States.

The Siberian Forest.—As Canada holds a great forest reserve for America, so the corresponding parts of east Asia promise to serve that continent. Much of the Amur River basin is useless for agriculture as we now know it, but, like upper New England, Newfoundland, and Quebec, good for forests. A recent estimate (U. S. Con. Rep., Feb. 15, 1911) places the forest area of the Amur basin alone at 20 per cent, or 400,000 square miles, an area much greater than all the forests of west Europe. This and other forests of northeast Asia are the real hope of the Mongolian people for a nearby timber supply. In Siberia west of Lake Baikal the forest belt narrows but it reaches clear over to the Urals, an area of vast but unknown extent situated in admirable relationship to the agricultural belt to the south of it.

The Tropic Forest and Its Products.—The torrid zone contains a larger area of forest than does the temperate zone. Tropic woods are in great variety and many are of surprising beauty and hardiness, but the forests upon the whole are very much less valuable than those of the cooler north with its less favorable conditions for the growth of vegetation. The relative uselessness of the tropical forests is due to poor quality and inaccessibility. Many trees of the tropic forests are crooked and useless for lumber. They are often worthlessly soft and weak, and the good ones are almost always mingled with many other species. This mixture of species is a striking and important contrast to

e practically solid stand that exists in the pine or spruce ests of Maine, the fir of Washington, the cypress of Louisiana,

. 163.—Tropical forest in southern Mexico. Good logs are scarce and industry quails before the task of extricating them. (W. L. Tower.)

the oak of West Virginia. Those who gather tropic logs ually find but one tree of a kind in a place, surrounded by ndreds of useless specimens of other varieties. To make

matters worse, the heavy rainfall and the heat produce such a wealth of bushes, small trees, and vines that a man can only force his way through by first cutting a path. Thus the machete a long-handled knife, is the most universal tool possessed by th inhabitants of many tropical countries. With it they cut path through the forest in which each tree is often bound by creeper to a dozen others so that the felling of one tree is a most difficul process. As the jungle is often swampy, it is evident that wagon can rarely enter to carry logs because the wheels woul sink into the soft earth even if roadways could be cut. Th nearest approach to the northern blessing of snow with its sle transportation is the annual floods of the rainy season, whic permit the floating out of those logs which grow on overflowe land and are light enough to float. Those that are heavier tha water, and most of the tropical cabinet woods with their grea strength and beauty are heavier than water, must rot whe they grow, or be dragged out at great expense. Consequently the chief timbers exported from the tropics are the buoyan mahogany and cedar, of which the United States importe $3,000,000 worth in 1911, while all other cabinet woods importe were not one-tenth as valuable. One vast belt of solid gree girdles the earth wherever the land emerges from the equatori sea, yet this equatorial forest has thus far been of less use t man than if it were a desert with an occasional oasis.

The Philippine Forests, an Example.—The botanists tell u that more than a hundred species of useful woods are to b found in the Philippine Islands, which are largely covered wit forests belonging to the United States Government. It is no the number of species, but the goodness and cheapness whic makes them valuable. Ten species of trees, namely, yellow pine, Douglas fir, white pine, hemlock, western pine, spruce cypress, the oak, and maple, have furnished 95 per cent of American timber and made the United States the greates timber producer and exporter in the world. Despite thei riches in forest area and number of varieties the Philippine Islands, like many other tropic countries, are tree poor, and buy timber from the United States rather than supply us with it.

The Woods Exported from the Tropics.—Mahogany, the most important wood exported from the tropics, is hard, strong

aking a beautiful finish, and is much prized for furniture and nterior work. It is light enough to float and valuable enough o be hauled out of some locations where there are no floods to loat it. The best mahogany is shipped from the Island of Iayti, and an inferior product comes from British Honduras and Cuba. Like other tropical trees, the mahogany grows singly ere and there in the forest. The mahogany hunter, climbing ne tree, looks across the forest to locate the next mahogany tree owering above the level green, and then cuts his way to it. frican mahogany, a slightly different species, is shipped in irge quantities from coast ports between Senegambia and Kamerun in west Africa. The chief market for this wood is iverpool, whither it is shipped in great logs and forwarded to le finer wood-working establishments of Europe and the United tates. Cedar, the second tropical wood in commercial importnce, exists in many varieties, exported chiefly from the West ndian Islands, and the Gulf coasts of Mexico and Central merica. One of the chief uses for this soft light wood is the naking of cigar boxes and pencils. The third of the tropic oods is the teak, a wood which resembles oak in its physical haracteristics, but is much more valuable than oak for ship uilding because, unlike oak, it contains an oily substance which cts as a preservative, and will not corrode iron as does the oak. grows in the forests of southeastern Asia from India to China nd has been planted for timber purposes in Java. The chief ipply of commerce comes from Burmah where it is floated own the Irawadi River to Rangoon, the Salween to Moulmein, nd from Siam where the Menam River floats the valuable logs own to Bangkok, and Paknampo for shipment. As Britain the greatest ship-building nation in the world, she imports ost of the teak.

Minor Products of the Tropic Forest.—The tropic forest is ore important for its minor products such as rattans and gums an for its major product of wood. Of these minor products e greatest, rubber, greater in value than all the other products the tropic forest combined, is left for another chapter. Closely lied to it from the botanical standpoint are many other gums hich are produced from the dried sap of trees. The well-known gum arabic" so commonly used as office paste has the useful

quality of being soluble in water and is plucked from trees by natives throughout the half-forested belt that lies between the jungle and the desert and reaches across Africa from Senegal to Abyssinia. It is also shipped from Somaliland, India, Australia, and Cape Colony. In Kordofan there are plantations of trees for the production of this gum.

Gums of another class known as copals are with difficulty soluble and therefore serve as the basis of varnish used for vehicles. They are produced by many trees, one, the Kauri gum of New Zealand, is extra-tropical, being found in a fossil condition covered by the surface earth where it has dropped from Kauri trees of past ages. It has been diligently dug for the last sixty years and is still being found, and small quantities are produced by the living forest. Other copals are dug from the earth in Madagascar, Zanzibar, and adjacent Africa, but the greatest center of shipment for these gums is Singapore, the Malay metropolis. Here also is gathered for shipment a large proportion of the world's rattan, the jointed stem of a creeping vine that runs for hundreds of feet through the tropic tree tops and helps to bind them together in the jungle mass. Properly split it makes the cane seats of chairs.

Nuts make an entirely different class of forest product and one of indefinite expansion. From Para, Brazil, come the long dark Brazil nuts (or butter nuts) with their triangle cross-section and rich white meat. They could apparently be produced in indefinite quantities if desired. From Ecuador and Colombia several thousand tons of palm nuts (Corozo or ivory nuts) are annually exported to European and American button factories. This valuable nut, sometimes as large as a hen's egg, is the product of a palm that grows wild in most locations, sometimes yields thirty pounds of nuts and lives for fifty or one hundred years. The market has of late been partially supplied by somewhat similar nuts from Italian Eritrea (on the Red Sea), and the Soudan.

Tropic Imports of Temperate Zone Woods.—It is true that some tropical timbers have great hardness, strength, durability, and beauty, but many of them are so hard that tools will scarcely work them. Furthermore, their inaccessibility makes them as useless as the millions of tons of excellent building stone which lie

alueless in the heart of every mountain region far from growing ities. Despite the riches of millions of square miles of jungle nd forest lands, American lumber is imported by practically very tropical country in America and Africa, and occasional nipments go even to Asia and the East Indies. The rubber merhants of Para or Manaos on the Amazon, desiring to build a arehouse, prefer the soft woods of the United States, into which ley can easily drive a nail, to the beautiful but hard cabinet woods the forest that actually encroaches upon their building lots. his choice explains our lumber trade to the forest-bowered parts Brazil, the Guianas, Venezuela, Colombia, Central America, id Ecuador. In Peru the commercial centers along the Pacific e located in a desert three or four hundred miles away from the eruvian forests on the Amazonian low plains accessible only by ie pack train across the snow-clad passes of the Andes. In olivia, the same mountains and desert shut off the possibility native lumber. Chile, which is in the temperate zone, has niferous forests in her rainy, cold, southern provinces, but cilities for getting out logs and sawing lumber are so much etter in the states of Washington and Oregon that most of the mber for treeless north Chile comes from that source rather an the south temperate forests. The Argentine Republic, the ost commercially progressive of all the South American untries, has large sub-tropical and tropic forests in her northstern territories where the jungle conditions prevail. But her nters of population are in the temperate zone and she is the rgest of all South American lumber importers. Her extensive mperate-zone forests at the base of the Andes in Patagonia are o distant from ports and transport facilities to be developed as t. The form of the two Americas makes great contrast in mber resources. The large forests of the north temperate zone e in the high latitude where the areas are great. In these latides of good timber South America tapers to a point and suffers om aridity.

The Forests and Forest Imports of the South Temperate one.—The south temperate zone, so important in the production of meat, wool, mohair, and grain, is strangely lacking in ports of lumber. Most of the south temperate zone is in the itude of Spain and New Mexico and is too dry for good forests,

the only important exceptions being the small and rough points of South America (in part), of New Zealand, and the island of Tasmania. This explains the fact that South Africa and Australia, like temperate South America, are importers of lumber from the United States and Sweden, although certain small sections in southwestern Australia produce two species of export wood. They are members of the Eucalyptus family, the karri and jarri, which, through their hardness and durability in the ground, are well suited for wooden pavements and are exported to European cities for that purpose. The northern island of New Zealand has some splendid forests of the well-known gum-yielding kauri, a tree furnishing logs 8 to 10 feet in diameter and 100 feet long. New Zealand's lumber export, though small, is growing.

Naval Stores and Tanbark.—Important among the many minor industries of the forest is the preparation of naval stores, the name applied to turpentine and resin, products of the sap of certain pine trees, having the same relation to the tree as the gums of the tropic forest. The resin is the residue remaining when turpentine has been distilled from pine sap. The chief center of production is in the long-leaf pine forests of the southeastern United States; Charleston, Savannah, Pensacola, and Mobile being important points for the shipment of these commodities, with Fernandina, Florida, the greatest of them all. They are also shipped in small quantities from the pine forests in the sandy plain of southwestern France near the Bay of Biscay. The manufacture of naval stores, as carried on in the southern United States, is very injurious to the forests. Great wounds are made in the base of the tree from which in a few years it bleeds to death. During the process it is exposed to easy destruction by fire, and is easily overturned by wind storms. Inasmuch as the slabs which are burned or wasted around many southern saw mills also contain large quantities of sap, as do the small branches and tops which are left in the woods, it is likely that we will have more economic methods of gathering naval stores. Some processes already discovered take all this refuse wood and soak from it the sap for distillation and leave the pulp thus purified for the making of paper.

Another industry which has caused great destruction of American forests is the gathering of bark for tanning. The chief

ark trees are the hemlock and certain species of oak growing rom Pennsylvania southward on both slopes of the Appalachians where millions of good trees have been cut down for their tanark alone, the trunks being allowed to rot. In 1909 the hemlock ark output was 700,000 tons and oak about half as much. This hameful waste of logs still goes on to some extent in the eastern ountry and also in California, where in the Coast Range there is a

to. 164.—One of our crimes against posterity is this Georgia saw mill slab fire that burned for 25 years without stopping. (U. S. Forest Service.)

onsiderable collection of tanbark from one of the western oaks at grows among the redwoods. The tanbark district of Wisonsin and Michigan (chiefly hemlock) is second to the Appachian in output.

Wood Manufactures.—The manufacture of the heavy log into ugh lumber naturally clings to the forest, although special onditions cause some export of logs, especially of such high uality woods as mahogany and walnut. The further manucture of lumber, usually carried on in planing mills, tends to ncentrate near the market in or near centers where building

operations are largely carried on. This industry tends to cling to the market because the rough lumber is so much more easily moved and stored than the easily injured dressed plank or the sash, doors, blinds, and special shapes that the planing mill turns out.

The same factors tend to locate furniture manufacture in great centers of consumption, especially in timber-importing countries. Thus London is both market for product and center for raw material because the wood (imported) is unloaded there from ship. In the United States the frontier lumber town has raw material and lower living cost to offset the market advantage, and very low freight rates to reach the market, so we have had a great furniture industry developed in Grand Rapids and other towns of the Lower Peninsula of Michigan, and more recently the same industry is rapidly increasing in North Carolina.

Paper.—In 1870 it would have seemed preposterous to place a discussion of the paper industry in a chapter dealing with forests and forest industries, but this is an industry which changes in raw material have transformed.

Some material for the easy recording of thought is important alike in industry, commerce, and civilization. The inhabitants of Babylon, Nineveh and other cities of Mesopotamia wrote on clay tablets and baked them, making the clumsiest but most enduring of all books. The Egyptians made papyrus to closely resemble paper by carefully pasting together the pith of a sedge-like reed of the Nile bank, which was carefully cultivated on large areas where now corn, cotton, and rice are grown. The wasps and hornets have for unknown æons made real paper by the process now followed by man—macerating wet vegetable fiber and spreading it out thin to dry. The Chinese invented paper making. The art spread thence through central Asia to the Arabs, was brought by them to Spain, and became established in England in 1588. Without it the printing press would have been of little value, for the only alternative was parchment, made of sheepskins, much more durable than paper, but too expensive.

What Paper Is and How It Is Made.—Paper is made of matted fibers, mostly vegetable. Nearly all plants have fiber in them, and as indefinite numbers of vegetable materials will make paper, the actual choice of materials is decided by the relative quality

eapness. For two or three centuries cotton and linen
id also woolen rags were the chief dependence because
ere a by-product of civilization and, until the middle of
ieteenth century, their quantity sufficed. In 1857 an
man invented a process of making paper from a tough
alled esparto, which grows well on arid, sandy, and rocky
id is found wild over large areas in the Barbary States of
Africa and in Spain, growing with especial luxuriance in
e localities near the sea. In less than thirty years after
oduction, it was much more important in English paper-
; than rags, which were also imported in large quantities
he continent. Changes follow each other quickly in
i manufacture, and by 1901 rags had almost ceased to be
ed into Great Britain, and the esparto was far outranked
predominating wood pulp, which is now making an ever-
ing part of the world's paper. Various other fibers are
a small extent, such as the bark of the baobab tree, which
ng, strong fibers makes the exceedingly fine paper used
k notes. The cotton stalk is full of fibers and some in-
i are promising us that it will soon be an important
il for paper.

r is made by grinding up the rags, grass, or wood until
ers are almost microscopic in size. They float in water
is kept at a uniform soupy thickness by stirring. For
es paper making was a handicraft carried on by the paper
and his family, who dipped sieves into vats of floating
id carefully lifted out upon the wire gauze enough fiber
uce a sheet of paper when properly dried. In the paper
e a stream of water uniformly charged with the fibers
ver thin sieves, leaving the fiber, which is transferred to
which press the ever-hardening sheet of paper, squeeze
i water, and lastly run it between hot rollers which dry it
it emerges at the other end of the rolls, 50 or 100 feet away,
ed roll of paper. Some machines turn out more than 500
r minute and send it away from the factory in sheets
i length wound upon spools into rolls 3 or 4 feet in diam-
Single machines make as much as 50 tons per day. If the
s to be for writing purposes the spaces between the fibers
ed by a process called sizing, which fills up the pores with

material chiefly composed of china clay, resin, alum, and talc a process that greatly adds to the weight of the paper. Clea water is a very important consideration because the dirt of th water can adhere to the floating fibers and thus pass into th paper. In a country like England which imports its raw materia and has many of its streams impure from sewage and factory refuse, clear streams are important in locating paper factories For this reason British paper mills are chiefly located on th slopes of the central mountain range in Lancashire and Derby shire, and in Scotland where the streams are clear. While th expensive hand method of paper making prevailed, its pric was high, and demand was small. Paper machines have greatl cheapened paper, thus greatly increasing its possible uses, an the resulting rapid increase of consumption has in turn called fo new raw materials.

Paper from Wood.—The manufacture of paper from wood pul was begun in the United States in 1867, and tree trunks no make the greater part of the world's paper. The cheapness c this material greatly reduced the price and depressed the trad in esparto grass, which had been a staple export of many of th Arab tribes of north Africa. The resultant hard times produce discontent which, as is commonly the case, was blamed upon th Government, and the French rulers of Algiers had serious troub with the tribesmen who found themselves poverty stricken throug the loss that followed the decline in the esparto trade. Befo the pulp era, paper making had been like many other manu factures a follower of cities and population. Our early pap mills had, like our woolen mills, been clustered along the sma streams in the vicinity of centers of population. Some of th best paper in the United States was made early in the nineteent century along country creeks near Philadelphia.

The great increase in the use of wood pulp for paper in th United States since 1890 has caused the transfer of the center c the paper industry to the forest districts of the New York an New England highlands. The spruce wood originally so commo in this region furnishes three-fifths of the wood pulp in th country and two-thirds of the paper mills of the country us water-power because it is the cheapest source for the great amoun of energy required to grind up the wood into pulp. So importan

s this relationship of water-power to paper that over 60 per cent. of the water-power utilization in the United States is in the paper mills. The combination of water-power and spruce logs makes the states of northern New England and New York the greatest paper-manufacturing district in the United States. Massachusetts is also an important paper state because it has excellent water and water-power, and it is near enough to get some of the pulp[1] from the northern forests, it has a skilled labor supply, and is also near the centers of population and of import for the supply of rags. This state alone makes two-fifths of the rag paper in this country and turns out a large proportion of fine writing papers, for the manufacture of which Holyoke on the Falls of the Connecticut with twenty-four paper mills, is the most specialized center in the United States. Pennsylvania, being a manufacturing region near the ports of import, also combines the rag paper with the wood pulp paper manufacturing for which her mountains supply the raw material.

Two Kinds of Wood Pulp Paper.—Wood pulp paper is of two varieties, the cheapest being simply ground wood which makes the flimsy and perishable newspaper. The better and more expensive kinds have the fibers loosened and the quality improved by the action of chemicals producing "sulphite" or "soda" pulp. These chemicals are put into tanks containing hundreds of tons of chips from which the chemical liquors, heated by steam, digest the cellular structure, leaving the fibrous parts which thus make a stronger paper. The better grades or book papers are made largely of poplar wood, which has a longer fiber, while the newspaper is practically all made of spruce. Two-thirds of the newspaper comes from the Adirondack region of New York and New England highlands, while three-fourths of the remainder is made in the southern edge of the upper lake forests in Wisconsin. Poplar (the wood of the tulip tree), being largely an Appalachian wood, supplies scattering mills from New York to Carolina.

Paper Industry Leads to Forestry.—A paper mill with its water wheel, grinding machines, digesting tanks, and large rolls is expensive and the impossibility of moving it makes it necessary

[1] It is common practice in both America and Europe for one mill to make the pulp which is shipped great distances to become the raw material for another mill.

that a paper company shall be sure of its wood supply. To do this they must often own the land, and, since they cannot flit from tract to tract after the manner of lumber manufacturers, some paper companies have become the foremost foresters in the United States, owning large areas of spruce land which they care for and cut systematically. As their enterprises are often located in the deep forest, the companies must sometimes even build and own the towns in which the people live who make their paper. A good example of this is afforded by the town of Millinocket, Maine, where the largest paper mill in the world, turning out 250 tons of paper per day, was built far in the forest beside a great waterfall. A special railroad was built to it, and the town built around it. The plant cost $25,000,000 or $350 per ton for the annual output—an excellent evidence of the impossibility of moving and the necessity for conservation of wood supply.[1]

The paper industry is undergoing rapid change in the source of its raw material. For a time the pulp supply was limited to spruce, then poplar and hemlock came into use and now it has been demonstrated experimentally that practically all of our native woods can be used. It becomes then a question of industrial adjustment. Already twenty species including pine, chestnut, and cottonwood are contributing to the national consumption of 4 million cords (1910) per year. Slabs and mill waste are also being utilized and there will soon be no excuse for the frightful wood waste of the past. The rival woods have cut in so rapidly on spruce that its percentage of the total fell from 6 in 1901 to 58 in 1910.

Paper from Straw.—In the eastern part of the wheat belt i Ohio, Indiana, and Illinois there is a considerable paper industr using straw, chiefly wheat straw, which makes cheap wrappin paper and strawboard, the so-called pasteboard of common us This is an industry which might easily move west and northwes with the moving wheat fields. It has already declined in New York.

Our Commerce in Paper.—No other people in the world us so much paper as the people of the United States with thei large consumption of newspapers, magazines and books, an

[1] *Cassier's Magazine*, Vol. 20, p. 420.

ıdvertising. We import rags from Europe by the hundreds of nillions of pounds, and from Canada a quarter of a million tons ıf wood pulp, about equalling in value ($5,000,000) the European ags. One of the surprises of commerce is the import by the Jnited States of a quarter of a million tons of wood pulp from Europe, chiefly Norway and Sweden. Despite our large manuactures our import of high-grade paper from Europe, especially rom Germany, is about as valuable as our export of newspaper nd book paper, which we send to the United Kingdom and to lmost all countries of Europe, Central and South America.

Paper Industry in Europe.—England, with no forests for pulp rood, is an importer of both wood pulp and paper, while all imortant countries of the continent are paper exporters except pain and Russia. Spain's importation of paper is an excellent lustration of the industrial backwardness of that country, for he exports thousands of tons of bulky esparto grass to be made ıto paper in England and Germany, and then brought back gain to Spain. Germany, located in the center of Europe 'here 400 million people are daily converting clothing into rags, as the best raw material supply in the world for the manufacture f fine rag paper, of which she is the greatest exporter, sending into every country in the world. Sweden and Norway, with ıeir large proportion of forests and mountain streams to furnish ıaterial and water-power, export newspaper and wood pulp to ngland and the other paper-manufacturing countries of urope.

Paper in China and Japan.—The Mongolians, who first invented aper, still make an excellent quality and a large quantity of it. 'he cheap paper is made of rice straw, while the so-called fine rice" paper of commerce the Chinese manufacture from the ith of a plant grown in Formosa. It is in Japan that we see aper rendering its greatest service. The people of the empire ave the highest per capita consumption of daily newspapers in ıe world, and, having a large forest area and a small arable area, ıey are compelled to make paper fill uses supplied in other ›untries by the products of agriculture. Thick, tough papers 'e substitutes for leathers, which they cannot produce at home wing to their lack of cattle. A very strong and durable paper made from seaweed, and the Udo, a bush, also called paper

mulberry, or paper plant, is grown on many Japanese hills for the very strong paper that can be made from its bark and ı for grain sacks, for waterproof tarpaulins, and even for wall houses. Paper is an excellent non-conductor of heat, and native Japanese house, adjusted tó the needs of a country ı is often visited by earthquakes, is made earthquake proof having a bamboo framework and paper walls. The Japaı paper umbrella and lantern are well known among us, and Japanese have long used paper napkins and paper pocket h kerchiefs. Efforts at introducing the Japanese paper plant southern United States have succeeded, but it has not yet bec the basis of an industry because of our great supplies of w pulp and other paper and fabric materials. While we have succeeded yet in establishing a paper industry on the Japa model, the Japanese have copied ours. A new $4,000,000] paper mill has recently been started at Tomakawai in the fore North Island of Japan. It is the largest enterprise of the kir the Orient, is located on the Pacific Ocean, develops 15,000 hc power from Lake Shikatsu 800 feet above, and its daily ou of 70 tons supplies 50 per cent. of the consumption of the em] All of the electric machinery and 97 per cent. of the paper mac ery came from the United States, most of the paper machi being made at Watertown, N. Y., in the midst of the Adironc paper district. The Japanese method is shown in that foreigner only was employed, an American to superintend erection of the machinery.

The Paper Industry of the Future.—This Japanese paper in northern Japan, like that at Millinocket in the woods of M recent new ones on the north shore of the Gulf of St. Lawre and especially a large mill owned by a London Publishing dicate in unagricultural Newfoundland—all these are sugges of the ultimate service of the far northern country that produce trees but not, under present conditions, any adeqı food supply. In the meantime cheap vegetable fibers of all k and from all climes are likely to enter more and more into making of paper for which there is every prospect of gre increased use.

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CHAPTER XII

FIBERS, TEXTILES, AND CLOTHING

The clothing of mankind is the product of wide-reaching world industries, which, with the production of the raw materials, touch in varying degrees all countries. The United States, with its preponderance in cotton production, is the greatest factor in the production of raw material for the world's clothing. The United Kingdom has a similar leadership in the textile manufactures, one-seventh of her workers being employed with textiles and clothing, while in the United States but one-sixteenth are so employed. If the figures for the production of raw materials could be added it is likely that the totals would be nearly equal in the two countries.

The discoveries that fibers could be twisted into thread and the thread made into fabric were of primeval antiquity, world-wide distribution, and absolute necessity before men in great numbers could occupy frosty lands. A multitude of fibers contribute to man's clothing, but cotton is much the most important. In 1911 its closest rival, wool, was used in the United States to the extent of 277 million pounds (scoured). The raw cotton consumption was 3,749 million pounds, over thirteen times as much.

I. THE SUPPLY OF RAW COTTON

The Universal Use of Cotton.—It is probable that few readers of this book ever saw a person into whose clothing cotton did not enter in some part, for it is alike the raiment of princes and of the savages who in the first upward steps in human progress clothe themselves with a breech cloth.

Cotton was in extensive and general use in India as much as twenty-seven centuries ago. Unlike most other important plants, its distribution throughout the part of the world suited to it took place at a very early time, probably by natural means,

lumbus and the early discoverers found it in general use West Indies and from Brazil to Mexico, in which latter y its use as clothing material was common. Likewise, n Cook in his discovery of the Pacific Islands found it on of the larger land areas in that part of the world.

ough generally known, cotton was until the end of the nth century one of the most expensive of fibers, because ibor was the only method of separating the fiber from the fact which made it more expensive than wool and linen used it to be relatively more expensive than silk is now. day "cottons" was the name of a fabric made of wool in m of cotton—a process now so diligently reversed. The an of 1790 had to choose between wool, linen, and leather, s last material, in the form of workmen's clothing, played more important part than now in man's raiment.

lution through the Cotton Gin.—In the year 1793, the gin started a revolution in the cotton industry and a it changed the course of American history.[1] Before ne cotton production required a most abundant supply p labor to pick out the seeds from the fiber, a day's work g in from 1 to 2 pounds of cotton. The cotton gin es the seeds by a very simple mechanical device in which revolving saw teeth catch the fibers, pull them through , through which the seeds cannot follow. This easy so reduced the price of cotton that it descended from to necessity and a great industry sprang up. Between nd 1890 the import of raw cotton into Great Britain d 7,000 fold. The greatly reduced price and increased ls shifted the deciding factor of production from cheap cheap land. In 1790 three-fourths of the British import m the West Indies and 8 per cent. was from Brazil, where is coast settlements grew and seeded it by hand. By production in the West Indies had changed but little as therefore a negligible factor. Brazil's share had, reatly increased, dropped from 8 to 2 3/4 per cent., e United States, with cheap and fertile land, was supply-r three-fourths of the entire world's supply, because

[1] nfluence of cotton on slavery and of slavery on the history of the tates is an interesting bit of the economic explanation of history.

the gin and tillage machinery had transferred it from the cla- of garden and hand labor crops, to the class of machine-grow field crops. The year before the invention of the cotton gi the American crop was so insignificant that the United State had in a treaty willingly promised to export no cotton to Gre: Britain, but within less than forty years we were sending Britai over two-thirds of her imports. So sudden was this chang that, while we were cotton importers in the half decade 1790-9

FIG. 165. The branching habit of the cotton plant and its uneven ripening h long baffled the inventors of picking machines. (U. S. Dept. Agr.)

we exported nearly half of our crop during the next five yea and by 1806-10, a proportion which we have usually maintain and often exceeded for a century.

During the century following the invention of the gin, cott has become the well-nigh universal clothing. It has alm entirely replaced linen, is competing with wool in the soft a warm flannelettes and canton flannel, and it is also very general mixed with wool in the production of cloth to which it ad cheapness and in some cases durability. Other cotton fabri

such as sateen greatly resemble silk, while mercerized cotton is often sold as silk, so that cotton is replacing this fiber also.

Natural Cotton Regions.—Cotton is a woolly fiber attached to the seeds of a shrubby plant and contained in a pod or ball, which at ripening time opens so that the white fiber protrudes in a mass nearly as large as a small apple. Although tropical and sub-tropical, the plant will grow almost everywhere throughout the world between 40° north and 30° south. Owing to combinations of geographical and industrial conditions, it is exported as yet from few and comparatively small areas and thus in its distribution throughout the entire world, it gives rise to a great commerce. The northward growth of cotton is limited by the requirement of about seven months of frost-free weather. It also needs a good summer rainfall without too great an excess of rain, a uniformly warm summer without too excessive heat, and bright sunshine. A frost-free season from April 1 to Nov. 1 is thus a necessity unless the plants are started under glass.

Cotton is like many other useful plants in that it tends to be more productive toward its northern limit. The unmitigated heat and moisture of some tropic locations cause the plant to flourish for years, but the gradual cooling of the early autumn or the drying of arid localities suggests death to the plant and drives it to seed and fiber production. It thus happens that this tropic plant yields most of its harvests under the threat of death by northern frost or arid thirst, while the vast reaches of green humid equatorial lands are cotton importers. Thus Mexico, with several thousand miles of tropic coast lines, grows three-fourths of its small cotton crop by irrigation in the northern interior.

Beginning of Cotton Growing in United States.—The cotton gin in co-operation with the negro labor of the southern United States caused cotton to become the leading article of American trade for many decades during which it was frequently declared that "cotton is King."[1] Slavery, which had become unprofitable for practically all industries other than rice growing in the swamps

[1] While it is not now so relatively conspicuous or so politically dominant, its export is more valuable than ever, having reached 585 million dollars in 1911, while meat and dairy products were 150 million and flour 50 million.

of South Carolina and Georgia, became profitable in the grc of cotton after the invention of the cotton gin and again assu importance in the United States. The great abundance of cl land in the southern states made easy the growth of cottoı slaves under plantation methods. Under this system of one c extensive agriculture, it was the common practice to clear ı pine forest, raise a few crops of cotton and corn, abandon field, and clear up more land, the ground being cleared in winter time by slaves who cared for the crop in the summer picked the fiber in the autumn. At the present time the : culture of the South is greatly limited and our soil resources n lessly diminished by a too great continuance of this one system.

The Possible Area in United States.—It is estimated 700,000 square miles of the southern part of the United St has the climate suitable for cotton. Owing to the ease of in by too much rain and cloudy weather the coast districts of S Atlantic States are not so well fitted as the districts further in where the greatest centers of cotton production are found. small proportion of cotton states actually in cotton at one shows how the one-crop system still finds room and also sl great possibilities of increased production. In 1879, 20 square miles were in cotton. This was practically double 1898, but by 1911 it had not reached one-fifteenth of the 700,000 square miles of possible cotton land. It is thus evi that the cotton output can be increased several fold and o crops can also be largely grown in the same belt.

Method of Growing.—The cotton seeds, about the size of a s pea, are planted thickly in rows in March and April. As soc the plants are established they are thinned with hoes, after w frequent cultivations with the plow or cultivator are neede keep down the weeds. During the growing season, the p attains a height of from 4 to 5 feet, produces a beautiful blos followed by a green pod, which later bursts open showing bunch of white fiber.

The picking of this fiber, which has thus far baffled all mac ery, must be done by hand. Several pickings are neces (usually four), beginning in August and extending through autumn and sometimes even into the mid-winter months if

winds and storms have not beaten it into the ground. The large amount of work involved makes picking the limiting factor in cotton growing and the range in prices of forty cents to $1.00 per hundred pounds shows the desire of planters to get the crop harvested. Owing to the light nature of the work, much of it is done by negro women and children.

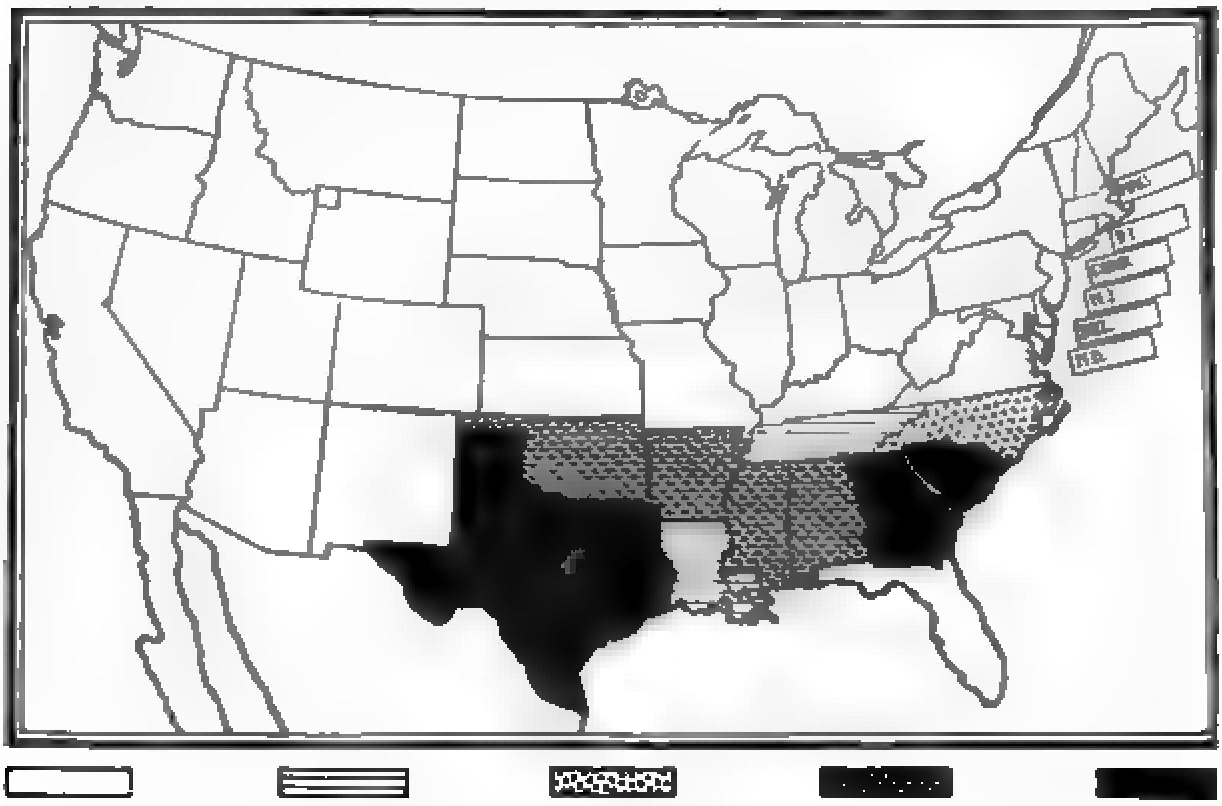
The cotton-growing industry has been seriously threatened by an insect, the cotton boll weevil. It came to us apparently from Mexico and destroys the crop by tunneling through the unopened boll and blasting it. The damage has amounted to scores of millions of dollars, but it will probably be a great blessing by giving a diversified agriculture to the South.[1] The ease with which the grower's cotton crop, indefinitely keeping, easily handled and king of money crops, could be mortgaged and the great difficulty of mortgaging any other crop were factors in the establishment of the great crop-mortgage system in the South after the Civil war.

This mortgage system still continues to some extent and has been an important factor in the continuance of a one-crop agriculture in which very few supply crops are grown, so that even the

[1] Mr. Bradford Knapp, writing of the Farmer's Demonstration Work of the U. S. Department of Agriculture (*Year-book,* Department of Agriculture, 1911) in connection with the outbreak of the boll weevil in Texas in 1904, says: "As long as the merchant and banker refused credit it was necessary to show the farmer how to produce the food necessary for his own family and how he could live at home on the products of his own farm and still produce cotton. He was instructed by agents in the raising of corn and was urged to plant a home garden. They raised cotton in spite of the weevil; at the same time they raised much more corn under the instructions of the agents than they had ever been able to raise before. Diversification became one of the principal means advocated for meeting the ravages of the weevil and has constantly been urged by the agents engaged in this work from the very beginning. The certainty that the weevil would infest all cotton-growing sections of the South made it apparent that the more rapidly the cotton farmer could be brought to diversify the better would he be prepared to meet the weevil.

"Cotton was the sole cash crop and was generally raised on what is known as the advance system. The cotton planter or small farmer obtained credit with his banker or merchant for the necessary provisions and supplies to make the crop and generally gave some sort of mortgage upon the crop and even upon his team and tools. At the end of the year the merchant or banker took the crop, sold it, paid the indebtedness for advances, and returned the balance, if any, to the farmer. When the weevil appeared and destroyed the crop, merchants and bankers refused to make advances, and the farmer found himself without credit, without food, and without money. The result of this condition was a financial and agricultural panic. Labor left the country, farms were abandoned, stores closed, and disaster was apparent everywhere."

hay eaten by the mule is often imported in bales from north of the Ohio or west of the Mississippi. The man who advances the money to the cotton grower does not encourage the growth of other crops, nor the development of a more rational agriculture, because no other crop is so easily mortgaged, so easily kept or so readily salable as cotton. Thus the South, which has excellent natural facilities for the development of live-stock industries and the growth of forage crops, continues to import mules and hay and corn, butter, cheese, and pork, which it might produce as cheaply as any other part of the world.

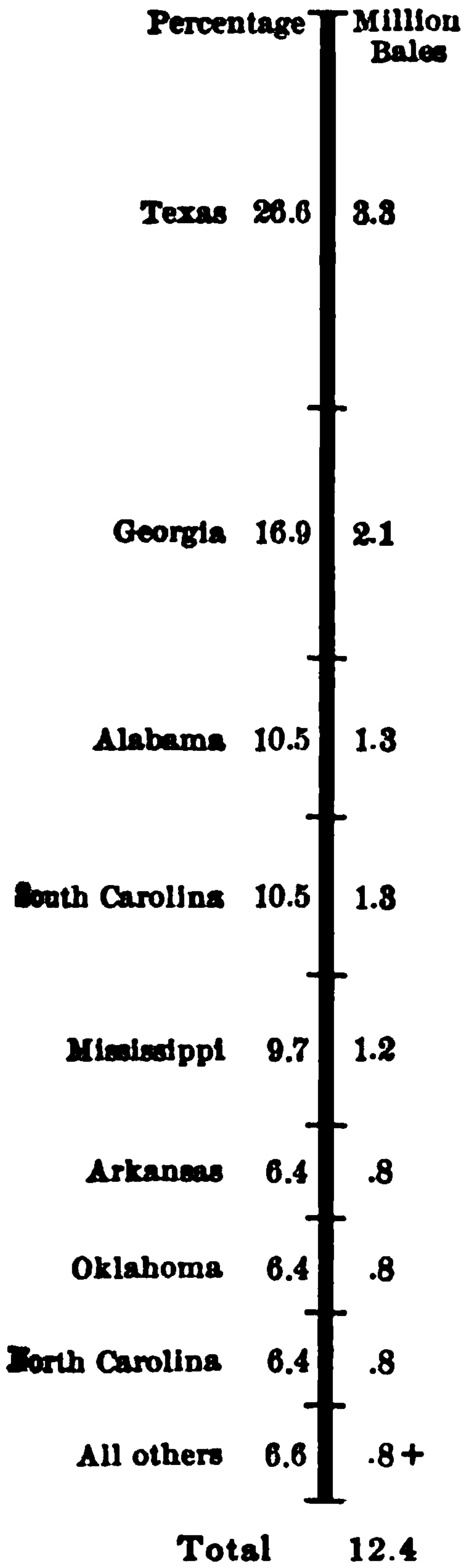


Less than 50 lbs. | 50-150 | 150-250 | 250-350 | over 350

FIG. 166.—United States cotton production in pounds per capita by states, three-year average, 1909–11. (U. S. Dept. Agr.) Pop. 1910.

Important Cotton Districts.—Cotton is grown in every county and almost every township (often called district in the South) from Norfolk, Va., to Austin, Texas, and up the Mississippi to Memphis, but three localities with unusual soils stand out conspicuously. One is the rich, black prairie of Texas, another the so-called Mississippi "bottoms," a term chiefly applied to the alluvial land to the east of the Mississippi River between Memphis and Vicksburg, which, like similar land in the flood plain of this river, is occasionally fertilized by the mud deposited when the river overflows its banks and floods the whole region.

third district in which the natural fertility of the soil suffices re a crop nearly double the national average of about 200 ds per acre is the so-called "Black Belt" of Alabama. This wide limestone valley, running from east to west a little the central part of that state and having a fertile limestone



7.—United States cotton pro-n, three-year average, 1909–11.

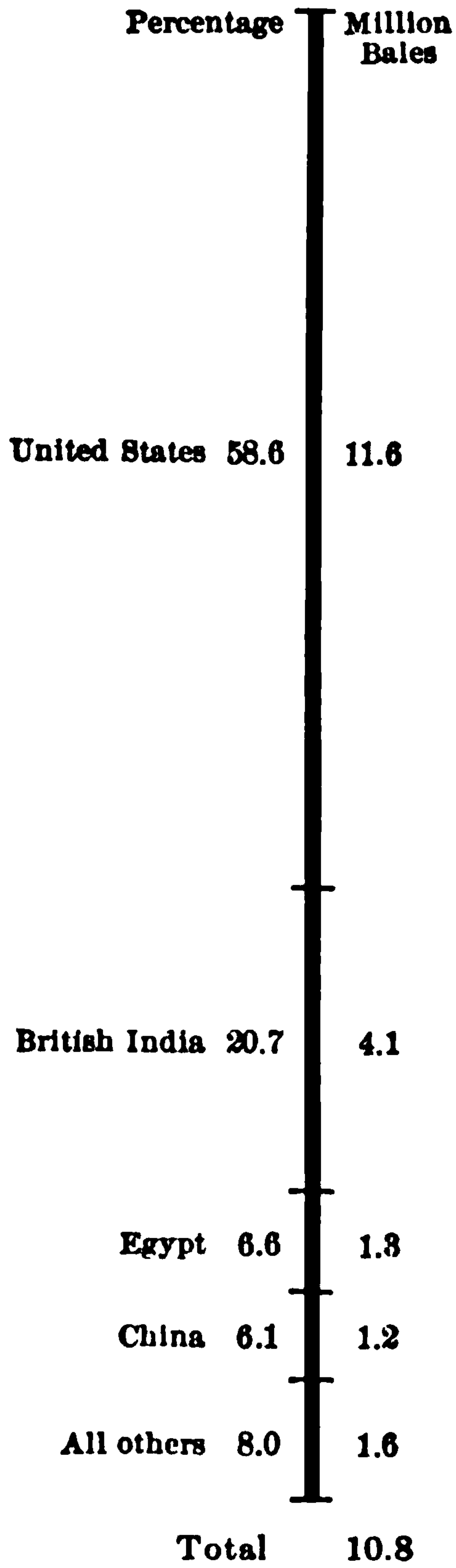


FIG. 168.—World's cotton production, three-year average, 1908–10.

exceptional productivity for cotton, which, like many other , does its best in soils rich in lime. The center of cotton ction has steadily moved to the west during the last sixty , until recently it shifted to the eastward, due largely to nfluence of the weevil. But despite this pest, Texas yet ces more cotton than any other state.

Upland and Sea Isle Cotton.—The fibers of the ordinary upland cotton, the chief product of the United States, are a little less than 1 inch in length, but a variety known as Sea Isle cotton considered the best in the world, has fibers as much as 2 1/2 inches in length with an average length of over an inch and a half. This long fiber produces a superior thread and commands a high price for use in the manufacture of fine fabrics. Sea Isle fiber is chiefly grown along the low sandy islands (barrier beaches) off the coast of South Carolina and Georgia and seems to require heavy rain, much moisture, and the slightly saline soil and air of shore districts. It has recently been introduced to the adjacent mainlands where the amount grown now exceeds that from the isles. It has also been introduced into the Pacific Islands of Tahiti and Fiji, the shore district of Queensland in Australia and into the West Indies.

Asiatic Cotton Growing.—Asia is second to North America in cotton production, and India is, according to published statistics second to the United States in production. China is a rival o India in cotton production, but of Chinese industrial statistic there are only fragments and the amount of her cotton crop is matter of conjecture, but it must be great. In addition to meeting the demands of the enormous population, whose chief clothin is home-grown cotton, a quarter of a million bales are annuall exported. China is an excellent cotton country. It is essentially a duplicate of the eastern part of the United States in latitude, relation to the land mass, and adjacent seas. One of th regions of greatest Chinese production is the Hoang Ho Valle in the provinces of Chili, Shansi, Shensi, and Honan. The loos soil of this region and also of the Wei Basin of south centr Shansi is admirably suited to cotton. The prohibition of th growth of the poppy for opium is increasing the cotton outpu of China. Cotton also grows over a large area in souther Korea, where it has been a family-supply industry. It is no under Japanese direction spreading out as a commercial cro and is also grown to a small extent in southern Manchuria.

Cotton Growing in India.—In India, the second country i cotton export, the leading cotton area is located on the plateau between one and two thousand feet above the level of the sea an lying east of the western Ghats Mountains in the region comme

ially tributary to Bombay. The crops depend upon the mon-oon rains of summer, which in this section are rather light, owing o the mountains which intercept the rain-bearing winds.)roughts follow rains and no cotton could be grown at all but ›r the very peculiar character of the so-called black cotton soil, 'hich in the rainy season is often flooded, becomes a tenacious iud, and after the rains have ceased dries somewhat and is ›parated by countless cracks into hard lumps. This does not revent the spongy soil from retaining sufficient water to mature ıe cotton, which is here sown broadcast like wheat, in a lava ›il so enduring that some of it has been planted annually to ›tton for centuries. The yield is only about half of that of the 'nited States and because of the short staple the quality is oorer. The influence of climate is shown by the improvement : Indian cotton when grown in America. Cotton can also sur-ive standing in water in India, but in the United States it is ıtal because of the smaller amount of evaporation by which the lants rid themselves of surplus moisture. In northern India, ›me cotton is grown in the irrigated districts along the Indus ıd Ganges.

There is cotton climate from India to Asia Minor and the :raits of Gibraltar and cotton is grown in scattered spots ıroughout the region, but most of it is so arid that the small 'oportion of arable land must be used to grow food crops. nder the stimulus of famine prices during the American Civil 'ar, cotton growing in all these countries rose rapidly to an ıportant amount. Turkey, for example, produced 235,000 ıles, but soon declined to less than a fifth of that figure. Ten .ousand bales of cotton are grown in Italy and Greece, a little Malta and Cyprus, and in Asia Minor, under the influence German enterprise, it is again increasing on the plains of oniah and Cilicia, and the province of Adana now produces arly 100,000 bales for manufacture at Tarsus and for export ›m Mersine. Cotton growing is on the increase in the Jordan ılley and Mesopotamia has great possibilities when new irri-tion works shall again rehabilitate the seats of the ancient Em-re. Persia grows over 100,000 bales on the few oases that en-'en her arid wastes, but Asiatic Russia is by far the leader of Eurasian cotton growers west of the Indus.

Cotton in Central Asia.—The building of the railroads from the Caspian Sea into the oases of central Asia, especially Ferghana, has made possible the export of cotton which has been grown in a small way for local use for many centuries. Within two decades after the railway was built, cotton became one of the most important money crops from the irrigated fields of the oases which are fed by the melting snows of the high mountains of central Asia. The product, however (642,000 bales, 1910), is insufficient for the needs of the Russian Empire, and there is small possibility of its large increase because of the very limited areas for which it is possible to secure water. One-fifth of the irrigated land of Turkestan[1] is in cotton and the Russian government is trying to double this by arranging for an outside supply of wheat so that the wheat lands of Turkestan can be put to cotton.

Egyptian Cotton.—The Nile Valley of Egypt is without question the best cotton field in the world. The alluvial soil of the Nile Delta fertilized by the flood waters, with almost continuous sunshine and warmed by a climate in which there is a steady rise in temperature from spring to summer and a steady decline from summer to autumn, produces 500 pounds of cotton per acre, which is double the yield of any other country. Unfortunately, its area is not great. Furthermore, the quality of Egyptian cotton, owing to its long, strong fiber, is better than that of any other but Sea Isle. It commands a higher price, and the production which covered 1,350 square miles, or one-seventh of the cultivated area in 1885, increased to 2,670 square miles in 1908, an area greater than that of any other crop and covering one-fourth the fields of Egypt. Cotton is there a recent industry and can only be grown by frequent irrigation, which has been possible only since the introduction of modern engineering devices under European management. The greatest of these efforts at cotton extension is the building of the Assuan Dam, completed by the British in 1902 at an expense of $125,000,000. It holds back vast quantities of water from the season of flood until the time of need and permits irrigation at all seasons. Flooding of

[1] About one-twenty-fifth of the area of Louisiana is in cotton and with adequate drainage works practically the whole state, 29 million acres, 45,000 square miles, is fit.

he Nile has gradually spread a layer of mud over the Egyptian elds permitting continuous cropping for many centuries without ny other fertilization. Already there is complaint from the atives that the fields of lower Egypt are declining in fertility nce the Assuan Dam shut off some of the floods and the iud.

The Government began a rigorous inspection of cotton growing 1911, enforcing the destruction of diseased leaves and preventg overirrigation, with the result that the largest crop on record as harvested. Evidently, the possibilities of expansion here e far less than in any one of half a dozen American states.

Because of the climate, Egyptian cotton differs from others so eatly that it is imported into the United States in quantities 78,000 bales, 1910) greater than our total cotton consumption 1830.

Many attempts have been made in other parts of the world to ltivate Egyptian cotton, successfully, but the frequent reports success have not been verified by later experience. Texas in e district of San Antonio has a very similar temperature, but lacks the almost continuous sunshine of Cairo, while regions greater elevation even in upper Egypt produce an inferior er. Within the last few years it has been found that the nditions of the Yuma district of the lower Colorado basin in lifornia and Arizona, because of the great similarity of climate, oduce cotton that is quite the equal of that of Egypt. It is t likely, however, that the labor conditions of the Southwest th its high wages will favor cotton growing in competition with e Egyptian fellahs.

Peruvian Cotton.—The deserts of the coasts of Peru produce mall quantity of very excellent cotton, where sufficient water n be had to irrigate the fields. The great aridity gives this er a crinkly character which, in combination with its brownish lor, makes it of high value because it can be successfully xed with wool in the production of expensive fabrics to which gives a greater strength.

Brazilian Cotton.—Brazil grows about twice as much as issouri grew in 1911. It is grown upon the coast district, per cent. of it in the vicinity of Pernambuco where there is a tinct dry and rainy season aspect to the climate. There has

been a considerable decline since the period of unusually hig prices during the American Civil War and the small changes o price which raise or lower the American product seem to hav but little influence upon Brazil. It is a region of great unde veloped lands but with small prospect of much change in cotto production at any early date.

The World Supply and European Efforts to Enlarge It.—O the world's commercial crop, the United States produces about six-tenths, India two-tenths, Egypt one-tenth, and many scattered countries the remaining tenth. The great dependence of Europe upon the United States for its cotton supply causes any kind of disturbance of cotton growing or export in the United States to be sharply felt in Europe and gives an unpleasant feeling of dependence upon this country for the raw material of one of the most important of all industries. During the American Civil War, when the northern states blockaded the South and stopped the export of cotton, the price rose to a dollar a pound and the consequent closing of mills caused great hardship to the cotton manufacturers of Lancashire, England, and other European textile districts. Again in the year 1901, a short production and subsequent speculation in American markets caused high prices and the shutting down of mills in Europe. As a result every European nation with tropical colonies is diligently trying to stimulate the growth of cotton, but the results so far have not been very encouraging, although the possibilities are doubtless very great. Good samples of cotton are reported from many places throughout the Tropics and the possible areas are extensive. For instance, it is claimed that the supposedly unimportant Cook Islands in the Pacific have 200,000 acres of cotton land capable of producing enough cotton to feed the factories of a city. A British cotton-growing association is trying to revive cotton growing in the West Indies and to improve the quality of that grown in India, while the state railways in the British Colonies of West Africa have recently offered free transportation to all cotton for three years and the steamships offer free carriage to Liverpool for the first thousand tons. The French, German, Portuguese, Italian and Dutch governments are making similar efforts in Africa and the East Indies. The ultimate results are entirely problematical, but the British Cotton Growing Association report for 1912 shows

that the production in the various British possessions in Africa exclusive of Egypt increased from 10,900 bales in 1905 to 52,500 bales in 1911.

Probably the most promising of all the tropical colonial regions s that of upper Nigeria and the Sudan, a transition region between the desert and the tropical forest which reaches practically from the Atlantic to the Red Sea with several hundred thousand square niles of territory, possibly rivaling in size the American cotton elt, and containing in places comparatively dense populations f natives who might be converted into a labor supply under European management. At the present time this region is ractically without transportation facilities and cotton developnent will come slowly if at all, but the climatic and human lements there are both favorable.

Queensland, Australia, has much cotton land, but the fact that he white population is very scanty and that colored races are igidly excluded makes any large industry impossible.

Probable Improvements in America.—With the continued apid spread of more scientific agriculture, with crop rotation and nimal husbandry in the cotton belt of the United States, the roduction can be increased several fold during the present cenury. The invention of a successful cotton-picking machine, which now seems assured, would work a great revolution by renoving the greatest labor element in its production and putting t on a par with wheat, oats, and corn, in all of which crops nachinery has made possible the production of many acres y a single individual. The cotton gin brought great emanciation to cotton growing, but cotton picking still depends upon uman fingers. This alone restricts the possible production of he grower to a fraction of what it might be with a successful nachine picker.

The stimulus to the breeding of early maturing varieties of coton produced by the Boll Weevil outbreak is likely to permit the orthward extension of cotton growing in this and other lands. 'or example, it is now thought that cotton will grow in the Crimea and the Russian province of Kherson north of the Black ea. In the period of domestic industry before 1860 cotton was rown on the peninsula east of the Chesapeake Bay. The exension of cotton growing 100 miles toward the poles would

greatly enlarge its possible production, especially in the Unit States.

By-products from Cotton.—The cotton seed, one of the mo nutritious of morsels, was for a long time thrown away, or ev burned. Later it was returned to the fields as fertilizer. Th came the discoveries that the oil in which it was so rich could l extracted and put to many and rapidly increasing uses. Tl manufacture of cottonseed oil is now an important by-produ industry throughout the South. The seed, more than 1: million bushels, and worth nearly a dollar a bushel, is hulle ground, and run through heavy presses to extract the (of which a ton makes 40 gallons. The oil cake which r mains after pressure contains about nine times as much of tl important plant foods, phosporic acid and potash, as does tl fiber produced by the plant. It is thus evident that the returni of the seed to the land is an excellent way to maintain soil fertilit but the food value is too great to permit such use. The gre richness of this cottonseed meal in proteid, of which it is nc the cheapest available source, has led to its appreciation as fo for dairy cows, and the present value, nearly two cents a poun is causing most of it to be used for that purpose, for which it shipped to every important center of butter and cheese produ tion in the United States, Canada, and Europe. Its use as breadstuff for human food has already begun in a small wa The oil is largely used for food in various manufactured forn cottolene, for example, and also as a direct substitute for a adulterant of olive oil, which it greatly resembles in food valu Unfortunately this oil, unlike olive oil, becomes rancid wh exposed to the air for a few weeks.

2. MANUFACTURE AND TRADE IN COTTON CLOTH

Spinning and Weaving in the Hand Labor Era.—Fibe of any sort, when twisted around each other, tend to cling togeth and form a thread, string, or rope. Cotton, being a flat holl tube, has unusual spinning powers. It is not known when m began twisting (spinning) threads of cotton, wool, and silk to woven together in cloth. It is a primeval discovery. Primiti peoples in every continent have some method of their own, al

evices for weaving. In the rudest or most complex forms 'eaving is the same as the method by which splints are made ıto a basket. During the early centuries of the Christian era, ıe material to be spun was held on a distaff and the thread, often vısted by hand, was, when finished, wound upon a spindle. The ›inning wheel, used at an early date in the Far East, was also ıdependently invented in several parts of Europe in the fifteenth ıntury, was universally used in that continent and was scattered ver the world, wherever European colonists went. The thread ıus laboriously spun was woven into cloth in hand looms, the ıdustry being carried on in the homes of the workers even when ıe product was intended for sale. Some people were spinners, thers did the weaving and cloth making for sale was a common ousehold by-industry throughout the western world in the iddle of the eighteenth century.

Textile Machinery and the Factory System.—In 1764, an nglishman by the name of Hargreves invented a machine called ıe spinning jenny which was the first machine ever used to make ore than two threads at one time. This invention promptly nt the spinning wheels to the garret and greatly increased the ıtput of a family of spinners. Five years later Cartwright in-ınted the so-called "water frame" or throstle, a spinning achine which could make the heavy warp thread. Ten years ter Crompton invented the "spinning mule" which was combination of the machines of Hargreves and Cartwright and hich has been largely used down to the present time. The 'esent spinning mule contains over a thousand spindles upon ıch of which a thread is wound and one man can operate two of ıe machines, making over 300 pounds of thread per day. While ıe Hargreves spinning jenny was used in the homes of the old-shioned hand workers, the spinning mule was best adapted to ctories where larger amounts of power could be generated. This ›wer was furnished at first by the water-powers of Lancashire, ngland, but steam, which was introduced into English factories ›out 1790, was soon utilized. For a few years there was a great ırplus of thread. The weavers, who had previously been able use the thread of six spinners and often had to go to the houses many spinners in the morning to get enough to weave during ıe afternoon, now found themselves utterly unable to handle

the vast quantities of thread which the new machines produced. In 1787, however, Cartwright invented a power loom which water wheels and steam engines could run, thus enabling weavers to use up the thread. One invention demands and usually produces another. The spinning machine demanded weaving machines and the weaving machines demanded cotton. In answer to this demand came the cotton gin (1793), six years after the power loom had made cotton scarce. Cotton quickly became cheap. This combination of cheap cotton, spinning machines, weaving machines, and the coal and the iron resources of England, enabled that country to forge rapidly ahead in cotton manufacture while all the continent of Europe was disturbed with the turmoil of Napoleon's wars. In 1785, the export of cotton goods from England was worth a million pounds sterling; in 1815 it was 22 million pounds, and during this period it increased from 5 per cent. of British exports to 38 per cent.

That short period of thirty years produced greater change in British industry than many previous centuries had made. It has been well called the Industrial Revolution, and, like inventions, machines, and styles, it has spread and is spreading to all manufacturing countries. Before this revolution, man used little artificial power and the manufacturer often lived in the village or in the country where he gardened, kept some live stock, and worked on near-by farms. He was near to the food supply and had opportunity to use his extra time to good advantage. After the Industrial Revolution, the worker found himself living in a city tenement to be near his steam-driven machine in the big factory. He was away from the earth, the one great resource. He had no chance to produce food in his odd moments and was dependent upon the factory wage and imported food. This removal of man from the land, this great disadvantage of the factory as compared to the domestic system goes far to explain the fact that with all the stupendous machines of the factory system, the condition of so many of the workers is so little better than it was in 1780 if, indeed, it is any better. They have been removed from opportunity of steady work and by-industries and taken too far away from mother earth, which is our support.

It is entirely erroneous to think of the machines of modern

nufacturing as having completed their evolution. Mechanical provement is going forward as rapidly now as ever, and to this provement the textile industry is no exception. Between 14 and 1909 the number of textile workers in United States reased 20 per cent. and the value that they added to the raw terial increased over 50 per cent. As this was a period of rease in the hours of labor, the increased result is plainly due large part to the machinery.

. 169.—A modern loom. Spools of material to the right. Card board atterns overhead. (Crompton Knowles Loom Works, Worcester, Mass.)

The completed modern cotton mill is large and often costs er a million dollars. While one plant often completes the ocess, it is still a characteristic of the cotton-manufacturing dustry that the yarn is made in one place and the cloth in other, as was done in the days of the wheel and hand loom. us, England is sending yarn to the Far East to be there woven to cloth; Japan and India are sending yarn to China; the mills of

Massachusetts are sending yarn to Philadelphia, and the mi of Philadelphia are sending yarn to Rhode Island, while a wag carrying yarn from mill is a common sight in every cotton-man facturing city.

Present Distribution of Cotton Manufacture.—During t nineteenth century, cotton factories have spread to ma countries, and cotton cloth has traveled to the ends of t earth. The spinning wheel has disappeared before stea borne commerce in ever-widening circles, until now it ling only in exceedingly remote locations, where it continu not because it is impossible to transport cotton cloth, b because it is impossible to send out any product with which pay for it.

Homespun cotton cloth is still made in native hand loo in some remote parts of Africa, the Andean districts of Sou America, and large parts of Asia. Japan is still in the proc of emergence from the hand-loom epoch, and the Chin are, in the majority of cases, still clad in homespun. In t United States, the old method still persists in the heart the Appalachian plateaus of eastern Kentucky and Nor Carolina.

Of equal or greater significance is the persistence of the dom tic system in Europe itself. Ireland is reported to have 6,0 women lace makers and from the Donegal peasant women looms comes an increasing export (now $50,000 a year) of hom spun cloth, much prized for its texture, figure and home-ma vegetable dyes. Switzerland is far ahead of Ireland in th respect, having in household industry 130,000 industrial worker This amounts to 3.9 per cent. of the total population of Switze land, while in the United States but 8.3 per cent. of our populati is reported by the Census of 1910 as engaged in manufactur The 130,000 household workers of Switzerland comprise per cent. of the textile workers of the country, 56 per cen of the straw-braid makers and 52 per cent. of the woo carvers.

England's early leadership and present dominence in cotto manufacturing is shown by her leadership in the number spindles, cotton consumption, and export of manufactures.

MILLIONS OF SPINDLES IN THE WORLD

	1900	1912
Great Britain	45.5	55.3
Continent, Europe	32.	43.
Germany	8.	10.7
Total Europe	77.5	98.3
United States:		
Cotton States	4.3	11.5
Other States	15.1	19.
Total U. S	19.4	30.5
British India	4.9	6.1
Japan	1.2	2.1
China	.5	.8
Canada	.5	.8
Mexico	.4	.6
Total World	105.6	141.0

COTTON MANUFACTURERS, 1910

	Pounds of Cotton per capita	Exports, million dollars
ited States	25.4	40.8
ited Kingdom	38.1	583.866
nce	9.4	63.
many	12.8	105.318 (1906)
zerland	12.3	50.136
in	8.2	9.268
n	12.7	5.248
y	11.3	5.209

elation of Cotton Manufacture to Density of Population.— world's cotton mills produce many varieties of cloth between coarsest and the finest, and the distribution of the different ds is an admirable illustration of the effect of dense population n manufacturing industries. A pound of raw cotton may, h much fabrication, become several dollars' worth of the best chine-made lace, or it may become a yard or less of coarse,

heavy cotton duck. Several times as much labor and capital are required to produce the finer of these two products, even if machine made, while if the lace is made by hand it takes vastly more labor than that required for machine lace. Brussels is the center of the world's hand-made lace industry for the natural reason that it is the metropolis of the most densely peopled nation. Much of the lace is made by the Belgian peasants in the intervals of their farm work—a means by which they hang on to the great advantage of the domestic system—steady employment.

England's early monopoly in cotton manufacturing has given way, due to the rise of the industry elsewhere, as in the continent of Europe and in the United States, which regions were, in 1820, the chief British market. Although country after country has taken up the manufacture, the English product has nevertheless increased steadily, because it is the characteristic of new cotton industries to start with a crude product and England has held her own by making a finer and finer product for shipment to other lands.

The United States has an instructive distribution of the industry into regions of coarse and fine production. Cotton manufacturing had its origin in New England, where it is most developed, and it has had a recent rapid growth in the South, where it is less developed but progressing, as is shown by the fact that the average annual consumption of raw cotton per spindle in the South in 1880 was 155 pounds, in 1905, 119 pounds, while in Massachusetts it was 72 pounds, and in England 38 pounds. Granting equal speed of work per spindle, the average of the southern cotton mills in 1905 was three times as heavy, and the cloth, therefore, three times as coarse, as the British product, and about twice as heavy as the New England product. Speaking broadly, the South is, in its cotton cloth, exporting primarily its raw material. New England and Old England are exporting primarily their labor. The product of the Middle Atlantic States, as might be expected, is midway in fineness between that of New England and the South.

British Cotton Manufacture.—For more than a century the name of Manchester has been synonymous throughout the commercial world with cotton cloth. That city, the metropolis

ncashire, has been the center of the greatest cotton manuring district in the world and it is still adding spindles to quipment. The industry, established there as early as was partly due to the Atlantic winds which gave the moisecessary to the best cotton manufacturing. Later these Atlantic winds influenced the indusrough the water power of numerous streams that descended from the ne Chain and led to quick developafter the invention of the new mal. Both of these advantages have assed away. The moisture, like the rature of the factory air, can be conl and the factories of Lancashire have ince outgrown the water-power and l to steam, for which the local coal are very convenient. The third in Lancashire's start was the conit harbor of Liverpool, which has long ide ship connection with regions prog and consuming cotton. The city nchester itself has now ceased to be ictly a manufacturing city, and has e the sale and storage center for roduct of many surrounding towns. pool, the natural port of entry for this l, is the greatest cotton port in the because back of it lies the greatest n manufacturing district. It is, insurprising that after a century and a r, the British cotton industry should spread so little. Eighty-three per of it is still in Lancashire and 99 per of it is estimated to be in the district has extended to adjacent parts of Derbyshire, Cheshire, Yorkshire, but nowhere more than 40 miles from Maner. This district clothes Britain and supplies 70 per cent. world's export cotton cloth. The intensity of the indusas given to Lancashire ten times the population of Rhode

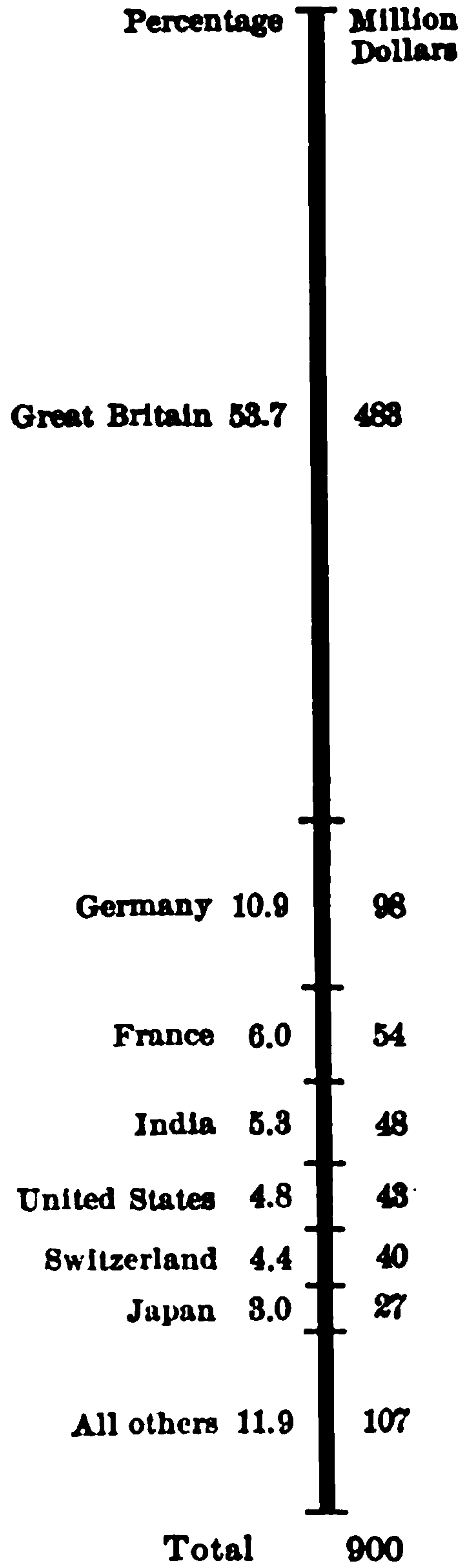


FIG. 170.—Exports of cotton manufactures, 1906. (Phila. Commercial Museum.)

Island although its area is only 8 per cent. greater. A son often succeeds to his father's place in the mill and the skill of the Lancashire operative may well be said to be hereditary, with factory work and school dividing the years of youth.

England has easily led all countries in the manufacture of cotton goods because she has had the great advantage of an early start and in addition she has had peace while others have had wars, she has had capital while others have had to borrow, she has had the most wide-reaching shipping connection and in addition she has had the local advantages of unrivalled coal, iron, and harbors. Because of her tariff policy, she has had cheaper food than any continental country and she has had cheaper cash wages than America. As a result of all these advantages the equipment and also the operation of a cotton mill is much cheaper in Lancashire than in Massachusetts (U. S. Con. Rep., Jan. 13, 1912). Hence the United States like many other countries places a tariff against the import of foreign (primarily British) cottons.

England sends fine cottons into the best cotton manufacturing districts of United States and of northwest Europe, and all kinds of cottons to the Mediterranean countries, to Russia, Norway, and Sweden. Her cloth goes to every colony in Africa, to the countries of west Asia, to the East and West Indies, to Central and South America, Australia and Polynesia; in fact, to the islands, colonies, and non-manufacturing countries everywhere. The British exports of cotton manufactures, $583,000,000 (1910), exceed by far in value the foodstuffs exported from the United States, $385,000,000 (1911).

Continental Cotton Manufacture.—The entire continent of Europe has about two-thirds as many spindles as Great Britain, but owing to the coarser product produced there is a greater relative consumption of raw cotton. Bremen and Havre are the chief importing points, and the greatest center of manufacture lies between the Elbe River and Paris, the North Sea and the Alps. This district includes northeastern France and the populous Rhine Valley with a host of manufacturing towns in Germany, Holland, Belgium, and Switzerland, in all of which fine cottons are made for home consumption and some for export. England, however, is still much the greatest of all exporters of cotton manufactures.

In Spain, which imports about a quarter of a million bales of cotton, the chief manufacturing district is Barcelona. Genoa is the chief cotton-importing port of all south Europe, because it receives some Swiss imports and is the point of supply for Milan and the manufacturing districts of North Italy. Here the water-power of the Alps is being rapidly utilized for manufacture, but Italy does not produce enough cotton cloth for home use, although Switzerland is per capita as heavy an exporter of high-grade cotton manufactures (chiefly laces and embroidery) as is Britain herself. Cotton maufacturing is important in the island city of Venice, to which the raw material goes directly from New Orleans, Galveston, Savannah, and New York, as it does also to Trieste to be manufactured in Vienna and other towns of Austria. It should be noted that most of the manufacturing of Austro-Hungary is done in Austria and that most of the Austrian manufacturing is done in populous Bohemia.

There is some cotton manufacturing scattered over nearly all manufacturing districts of Europe, Russian Poland, with its chief centers at Lodz and Warsaw, being the only other important district not previously mentioned.

Cotton Manufacturing in the United States.—In the United States cotton manufacture is an important industry, but we export less than 10 per cent. of our total product, and our imports are more valuable than our exports. It is, therefore, plain that cotton manufacturing for this country is, from a national standpoint, essentially as yet a supply industry as contrasted with Great Britain where cotton goods comprises about two-fifths of her enormous exports. While the number of spindles in the United States was increased by 6 million in the six years between 1900 and 1906, England's increase was 8 million in the three years between 1903 and 1906. The relative youth of our cotton industry is shown by the high character of our imports, one-half of which are lace and embroidery, coming chiefly from Switzerland, France, and Germany, and to a lesser extent from the United Kingdom. The United Kingdom sends us large quantities of fine cotton cloth, and yarn to be used in our looms.

In the United States the manufacture of cotton is concentrated in the region east of the Appalachians, in a long belt from Maine

to Alabama, with its greatest centers in New England an eastern base of the Appalachians in the Carolinas and (with a lesser center in Philadelphia. New England, ' million spindles, is the leader in cotton manufacturing likely to be for an indefinite time to come, although the s states with 11.5 million spind already consuming more cotto single year than does New Englan New England is making finer fab more valuable product.

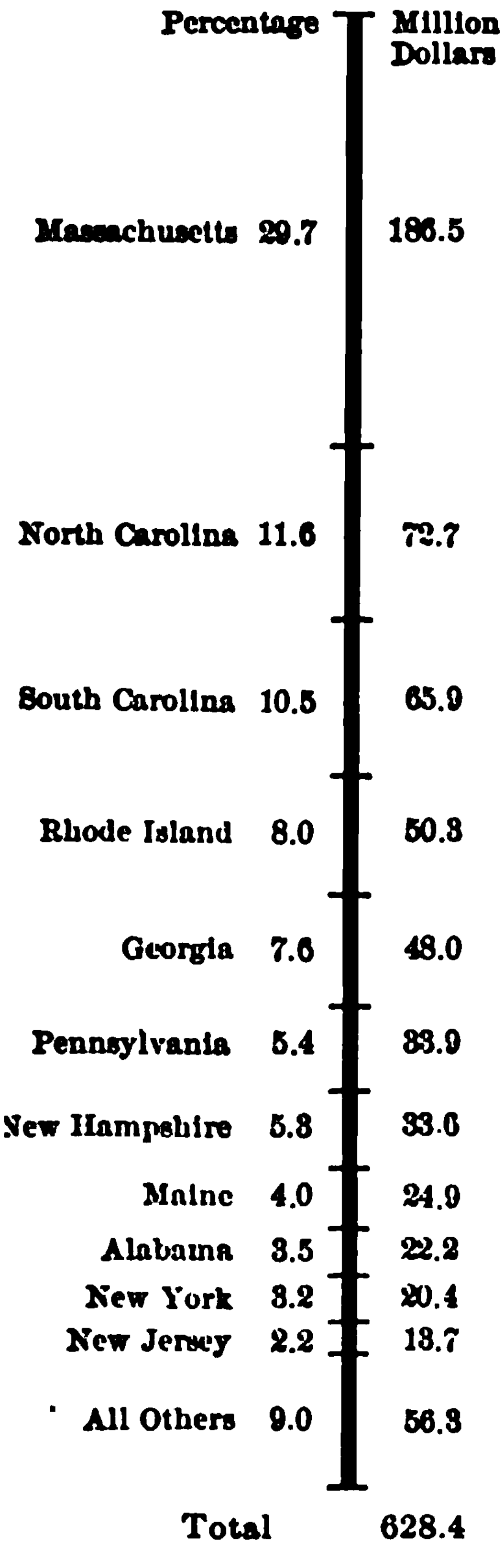


FIG. 171.—Value of United States cotton manufacturers, 1909.

The Influence of Water Power England.—The cotton-manufactu dustry is, next to paper, domin water-power more than any othe United States. The industry wa lished in New England along the falls of her glacial streams. The tions were, like Lancashire, c harbors for the service of shipp in a region of good labor suppl Merrimac River has falls of mo 50 feet at three places, and at th great cotton towns of Lowell, in chusetts and Manchester in New shire have arisen. Taunton Taunton River at the head of t water in eastern Massachusetts; F on the Connecticut in central chusetts; North Adams on the River in northwestern Massacl and Fitchburg on the Nash northern Massachusetts are all in to waterfalls for their prominence cotton industry, as are Pawtucke wick, and Woonsocket in eastern Rhode Island and L at the falls of the Androscoggin in Maine. Many mills started with water-power have grown so large that stea now be used.

The leading cotton-manufacturing city in the United St

day is Fall River, Massachusetts, where the little Fall River tumbles down to the sea and develops enough power to start the town. Being at the head of a bay, it has a good harbor and can take advantage of ocean transportation for the delivery of cargoes of cotton and of coal, which now drives practically all the machinery of the city.

The finest cotton cloth in New England is probably produced in New Bedford, Massachusetts, a town on Buzzards Bay with the same port advantages that have made Fall River and also Providence the great cotton centers they are. Many persons point to the fact that New England, lacking alike food, raw material, and fuel, must, therefore, be unable to compete with other localities. The industries are established with the powerful omentum bred by an early start and the weight of her handicap n fuel is often overestimated. A steam-driven Rhode Island 5,000 spindle cotton yarn mill near tide water had in 1910 an utput of $1,000,000 per year. The coal cost was $25,000 or 1/2 per cent. of the output. It comes by barge from Norfolk t a very low rate, costing $4 to $4.75 per ton at the mill. The oal handicap of a New England mill on tide water, over one in hiladelphia appears to be less than 1 per cent. of the total costs, ot a very important consideration. The nine years ending with 909 saw cotton consumption increase 68 per cent. in the South nd 12 per cent. in New England, but in 1910 the number of pindles increased 3.6 per cent. in cotton-growing states and 3.3 er cent. in New England. At this time Massachusetts alone ad 34 per cent. of the spindles of United States and the Carolinas 4 per cent.

The New England textile labor situation is typical of many merican industries. The people of New England, after a century's experience as textile workers, are skilled operatives, but he industry no longer depends upon native stock. Within ecent decades large numbers of French Canadian workers have ome from Quebec to the mill towns of New England to find mployment which their own country with its rapidly increasing opulation lacks. Latterly large numbers of Europeans have ome also with the result that Lawrence and other mill towns ave many languages and little English.

Southern Cotton Manufacture.—The cotton manufacturing

belt of the southern states is located near the fall line which r the boundary between the Piedmont district and the Atl Plain, and also in the Piedmont district, where it has been to take advantage of many waterfalls. In Alabama it is close to the coal fields. Its nearness to the raw product wh often grown in the immediate vicinity is an advantage[1] sl by no other important cotton manufacturing district in the w Despite these advantages, it was the labor that was the factor in locating manufactured cotton in the South.

The Appalachian Mountain district had a white popula dense in relation to the resources,, and therefore, with inadec opportunity for employment, so that wages were much l than in the North and West. These mountain people migi in large numbers to the mills just as the people of Quebec Europe migrated to the mills of New England.

In these localities, where agriculture with its low wages been the only industry, and with an abundant supply of c labor, which was and is exclusively white, the cotton man ture of the South increased with great rapidity. Bet 1880 and 1905 the spindles increased from 1/2 million to 9 lion, and the cotton consumption from less than 200,0(over 2 1/4 million bales. The mills of New England actually been surpassed in the amount of cotton consumed Massachusetts still has more spindles than the whole S The southern product is the coarser cotton sheetings and cl a product requiring a large amount of raw material with a s amount of labor, and that not the most skillful. This di has entered, therefore, more largely into supplying our ex than any other district because coarse uncolored cloth consti the chief bulk of our exports. Other kinds of cotton gooc volving a greater labor element we cannot export in compet with the manufactures of Europe. Our best cottons stay l and our export is consumed in largest quantities in coun where, like China and Africa, the coarse cloth is desired by a population. Consequently, American cotton cloth is worn the workmen of Cuba, Central America, many South Amer

[1] Owing to the fact that freight rates are usually less on raw tha finished products, this is questionable advantage for the southern c mill manufacturing for other localities.

countries, and the Philippines, and it furnishes the scanty raiment (loin cloth 3×10 feet) for some of the tribes of Africa. China alone has in some past years taken the greater part of our entire export of cotton goods.

Cotton Manufacture in Other Sections of the United States.—Many English textile workers have settled in Philadelphia and their imported skill has made possible the introduction of textile industries that had not previously flourished in America. Philadelphia is the chief center of cotton manufacturing in the Middle Atlantic States, the leader in the production of tapestries, cheneilles and other cotton goods that require skill in coloring. This city also sells machine-made lace, hosiery, and knit goods.

The dependence of the textile industry upon labor more than any or all other factors has caused the amount of cotton manufactured west of the Alleghanies to be very small, and it is not increasing.

The Extension of Cotton Manufacture.—Cotton manufacturing is an industry which many countries are trying to foster by high tariffs. Brazil is an example. Large cotton mills have arisen at Petropolis, a suburb of Rio Janeiro, where water-power is developed, as streams come down from the plateau, but the output is entirely inadequate to supply local consumption. Exactly the same conditions exist at Lima in Peru and at towns on the east edge of the plateau of Mexico. It is often the case that the cotton factories of new districts are built by capital, equipped with machinery and staffed by foremen from an older cotton district. The mills of Carolina and Georgia are often branch enterprises of New England companies. The mills of Mexico are largely French. A British company owns the one great mill of Venezuela at Caracas. The textiles industries of Italy and Spain even are largely British property.

The prospects of increased cotton manufacture in the Orient are many fold greater than in tropic America or Africa. The people of tropic America are too few. The peoples of Africa are so little used to industry, but the half of the human race that lives in eastern and southern Asia has the patient diligence born of centuries of labor, and the density of population makes them welcome factory opportunity. In 1880, India, with its millions

of cotton wearers took about one-half of England's exports, but since that time the import has declined as a result of the introduction of cotton mills built by English capital, equipped with English machines and directed by English foremen teaching the cheap laborers of India. Her exports are now about half as large as her imports and comprise both cloth and thread sent to China and Japan. In the Presidency of Bombay alone, there were in 1911, 431 cotton factories. One hundred and eighty-four of these factories employed 160,000 hands. In the same year the cotton employees of the United States numbered 387,000 and those of Britain 550,000. India even imports raw cotton from Texas and is competing at Aden with the American cotton cloths for the supply of Arabia and east Africa.

The example of India is now being duplicated in Japan. With its small amount of arable land and dense population, Japan is of necessity turning to manufacturing. She is now importing raw cotton from Texas, China, and India, and is likely at an early date to develop a much greater cotton industry than she now possesses. The American Consular reports fairly clamor with the accounts of the competition of Japanese cotton manufactures with the American, which they seem to be displacing in the markets of Manchuria and north China. The Japanese industry being comparatively new, competes directly with the low-grade American goods sent to the Chinese markets. If the Japanese labor is less efficient than the American, the wages as reported for certain Japanese mills for the month of March, 1912, twenty-three cents per day American money for men, and fifteen cents per day for women, give a powerful basis for competition and explain the statement that the Japanese can use American cotton and produce the finished cloth at from 10 to 25 per cent. less than it costs in America. Japan was (1911) in competition with west Europe by sending socks, shirts and imitation Turkish rugs to Salonica, Turkey. China with its coal, its iron ores and its millions of laborers will almost inevitably follow Japan's lead in a general as well as a special sense. New mills at Shanghai are operated by a Japanese company using British machines, American engines, Japanese coal and Japanese foremen. The cotton factory epoch in China is just beginning—the spindles now reported being but 900,000, less than 2 per cent. of the British

mber, but the use of machine goods is rapidly increasing. The ormous resources of coal, iron and labor become profoundly nificant when it is remembered that the high value of the raw aterial permits it to be taken half way round the world for anufacture and then taken back for consumption. American ece-goods dealers are already complaining not only of cheap panese goods, but of increasing output of Chinese-made goods [. S. Con. Rep., 1911).

Cotton and Cotton Goods in Commerce.—Cotton, the greatest aple of the world's clothing, gives rise to much commerce. As important cotton manufacturing country except the United ates produces enough raw cotton for its own use, we are sending to nearly all the manufacturing countries, and even the United ates is importing Egyptian and Peruvian cotton because they ssess qualities not found in American cottons. As the greatest tton grower is also a cotton importer, so no city, not even a eat cotton-manufacturing center, like Fall River, produces ough varieties of cotton goods for its own use. This gives rise a commerce in cotton manufactures so widespread that in the ores of almost any town will be found the cotton products of a en cities—the cotton duck of the south; the tapestries and it goods of Philadelphia; the ginghams and dress goods of ew England; the thread of Rhode Island; the fine products of reat Britain, Germany, France, and Switzerland. Cotton ods are one of the most universal staples of import. Made in w countries, they are imported by all, whether they are in the age of breechcloth, sombrero or silk hat. Cottons, indeed, nd to be relatively more important in the breechcloth stage an in any other, comprising, for instance, one-fourth of the imrts of Sierra Leone.

3. THE WOOL-MANUFACTURING INDUSTRY

Wool and Its Qualities.—Wool was originally the under coat the sheep.

Many animals have an outer coat of coarse hair with a shorter armer coat under it. The seal skin of commerce is such an nder coat. On the sheep this under coat has the character we ll wool and by long breeding and selection, sheep have come

to have their chief coat of wool, although this animal al: some hair and in some hot countries it has hair only, like or cow. Wool differs from hair and other fibers in being c or curled, so that it makes an elastic cloth, and also in covered with minute scales, whereas hair is smooth. scales overlap each other as do shingles on a roof, and wh natural grease is scoured from the wool, the scales catcl other and hold the wool together as a tangled mass. This q is utilized in making a matted threadless fabric called fel duced by beating, shaking and rolling the fibers together. felting process is also used in making hats, both soft and h

Woolen clothing is the best for cold, moist climates b it holds in the body heat, permits the moisture of perspi to pass through and yet does not become wet so easily fro as do fabrics of other fibers.

The Process of Manufacture.—The fleece as it comes fro sheep has impurities which amount to half or three-fourt total weight. Chief among these is the grease which (from the sheep, and serves to make the wool waterproof an keeps it from felting on the animal's back. Sometimes th is scoured to remove the grease in the country of prod before it is shipped to the market, but the danger of its i en route is causing a decline in this practice. Other imp in wool are dust, sand, burrs, and other seeds of plants, in combination with the differing qualities of the wool from varying breeds of sheep and the differences resulting from soil and climate, give wool an almost infinite number o mercial varieties, greatly complicate its manufacture, and wool buying a highly specialized task. The process of pre wool for use consists in washing it to get rid of the loos scouring it to remove the grease, combing and carding it rid of other foreign substances and to lay the fibers out st ready for spinning the yarn for the final weaving into clotl its relation to household industry and the industrial revol wool is like cotton and the other textile industries, excep it is older and much more widespread than cotton manufa Wool manufacturing has one by-product. The grease wasted, is now, especially in Germany, used for many pur including soap, lubrication and oiling leather.

Woolens, Worsteds and Shoddy.—The term "woolen goods" as used in the trade, includes only those woolen fabrics which do not show upon their surfaces the inter-twining threads of ordinary woven goods. Woolens are woven but the fact is hidden by a process called "fulling" in which the cloth is beaten to give a felting effect and finally the fibers are pulled up by being gently combed with teasles so that the surface has a uniform, smooth, almost furry, appearance. The chief woolen fabrics are broadcloth, cashmere, tweed, blankets, flannels and shawls. "Worsted goods" are those which are made of woolen yarns and show upon their surfaces their woven origin. "Shoddy" is thick, warm cloth made of re-manufactured wool fibers obtained by tearing up tailors' clippings and woolen rags, nixing them with new wool, and weaving all into a warm cheap loth. The demand of the English shoddy mills for wool rags is o great that they are imported from the United States, Holland, Belgium, France and Germany.

European Wool Manufacture.—Flanders was in the middle ges the great leader in wool manufacturing. The fertile, well-illed Rhine delta gave a good food supply for a manufacturing eople, and canals, rivers, land routes, and sea routes made asy the distribution of the goods produced largely from imported rool, then the staple export of England. The English kings ntroduced Flemish weavers into England during the eleventh, ourteenth and fifteenth centuries, but for a long time unfinished nglish woolen cloth went to Flanders to be finished and dyed. his practice seems to have ended about 1650 and England as now surpassed her old teacher, Flanders, in quality of output. nglish woolen cloths have been much famed during the period nce power-driven spinning and weaving machinery have been lapted to woolen manufacture, an occurrence that soon followed eir application to cotton manufacture. England, long a wool porter, now uses four times as much as she grows, and leads her countries in the excellence of her wool cloth. The towns Bradford, Leeds, Haddersfield in Yorkshire, just across a low ountain range from Lancashire, are known wherever fine oolen cloths are bought and sold. The same resources of al and iron that served the cotton industry have served other dustries, and these Yorkshire woolen districts also manu-

facture some cotton cloth and a wide variety of metal manufactures, for they are also near to iron and to the eastern harbors.

England has been unable to secure such leadership in the world's supply of woolens as has been the case with cottons, nor is the industry so important. It employs about a quarter

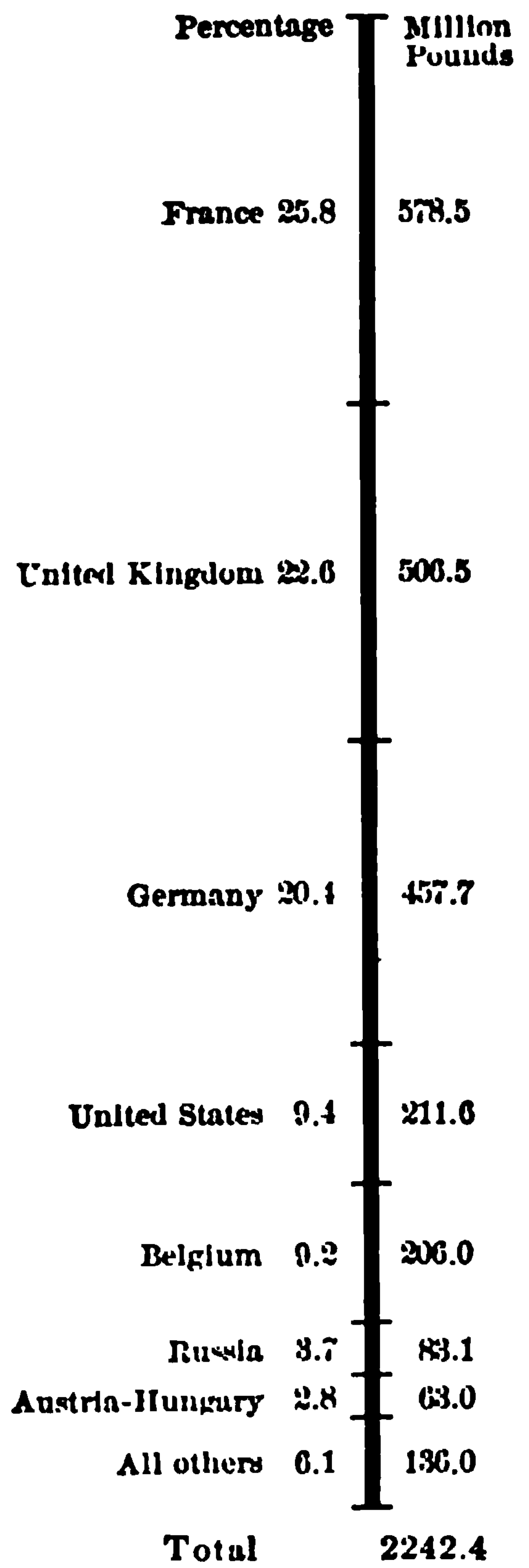


FIG. 172.—World import of raw wool, three-year average, 1908–10.

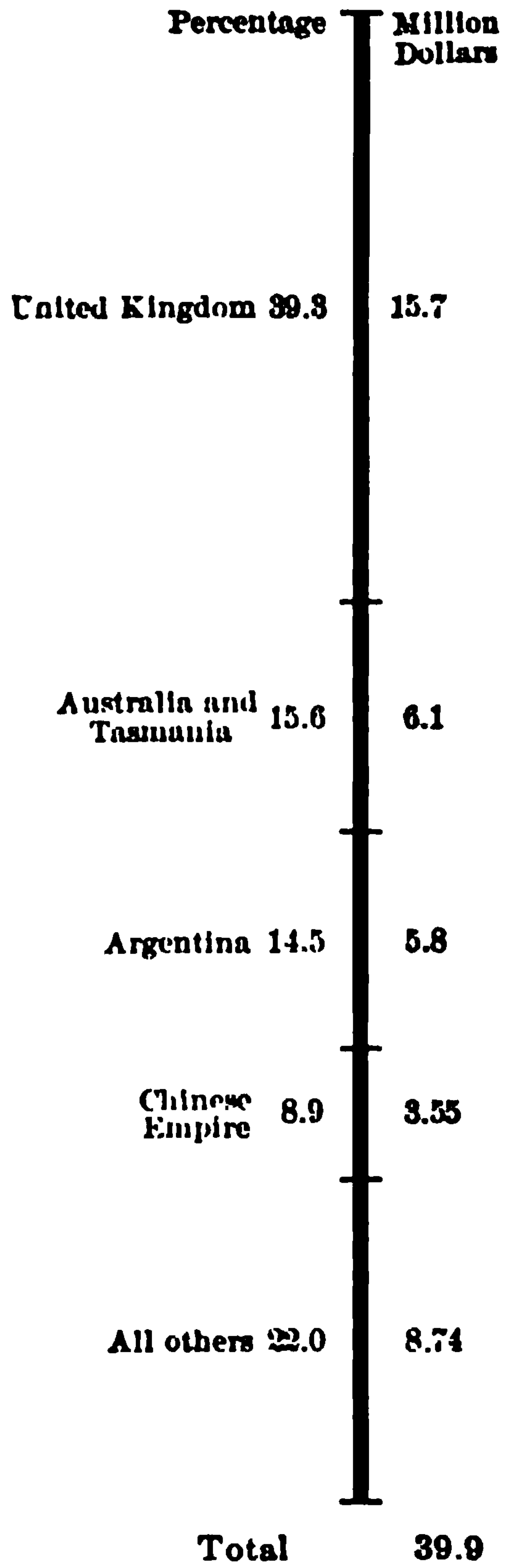


FIG. 173.—United States import of raw wool, three-year average, 1909–11.

of a million workers, less than half the number employed in the cotton industry. There is considerable equality in the amount of woolen goods produced in England, the United States, Austro-Hungary, Germany and France, while the rest of the world produces an almost insignificant quantity, but it should be

remembered that Britain produces and exports the finest grades of woolen cloths. The explanation of this greater equality in wool than in cotton manufacture is to be found in the fact that wool manufacturing was a worldwide domestic industry. The Industrial Revolution found wool an established industry and merely transformed it. Wherever men made flour, they made wool cloth and the adaptation of primitive water powers to the hand loom was a small change, much smaller than learning how to use a new fiber such as cotton. Cotton manufacturing was thus a new business, resulting from what was the practical discovery of cotton when Whitney's cotton gin made its production cheap. This came after the textile machines were established in England. That country, being in much the best position to manufacture textiles in factories, seized the new raw material and built up a world's trade in cotton, while wool, an industry as old as history, was still being made upon hand looms in millions of farm houses and in every textile village of Europe and America. With the tenacity which comes of an early start and the hereditary knowledge that lingers in families, wool manufacture has continued wherever, in the cooler parts of Europe and America, there is a population dense enough to develop any extensive manufacture. Upon the continent there is really but one wool district, extending from Vienna to the North Sea and the English Channel, including Paris and Berlin. This takes in the valleys of the Upper Danube, the Elbe, the Rhine, the Seine, and includes the densely peopled manufacturing region of Austria, western Germany, Switzerland, northeastern France, Holland and Belgium. This continental wool industry is newest and most progressive in Germany, which leads all nations in the deliberate and skillful promotion of industry. Silesia, Saxony and Westphalia, three German coal districts, are important wool centers.

Wool Manufacture in the United States.—In the United States we see the effects of the colonial importance of the woolen industry, for its manufacture is the most widely scattered of all the textile industries. Small mills, comparable to the rural grist mill and driven by small water wheels on insignificant streams, were established in the last half of the eighteenth and the first half of the nineteenth century over almost all the settled

country, and small factories are to be found to-day in every state of the Union, although in many of them the output is insignificant. The large scale manufacture of modern type, with big factories, is concentrated east of the Alleghanies, north of Maryland, in an almost continuous belt reaching from Wilmington, Del., and southeastern Pennsylvania, through northern New Jersey, southeastern New York, and lower New England into southern Maine. These factories, like the modern American wool industry, have largely arisen since 1865. In this concentration of the wool industry, we see another example of the dependence of textile manufacture upon dense population, the valuable wool of Montana, New Mexico, Ohio and distant foreign countries being carried thousands of miles to the place where abundant labor exists to manufacture it.

Philadelphia is the greatest single woolen manufacturing center in the United States, but almost every city of importance in this eastern belt has woolen mills. In the New England towns they are particularly common, especially in Massachusetts, which state leads all other states by producing more than a quarter o the total output. The two states of Massachusetts and Pennsylvania manufacture about half the woolen goods in the United States. In Rhode Island, which is little more than a collection o manufacturing cities, the woolen industry has great concentration since that tiny state produces half as much as Massachusetts more than New York or any states other than Pennsylvania and Massachusetts.

With the increase of population and capital woolen mills are now beginning to be built west of the Alleghanies. Ohio, the leading western state, ranked tenth in woolen manufacturing in 1900, with but a fraction as much woolen manufacturing as rural Vermont, but the rapidly rising woolen industry of Cleveland, the first large manufacturing city to the west of the Alleghany plateau, is very suggestive of a general westward movement.

There has been rapid increase in the woolen industry in the United States since the Civil War, when very heavy protective duties were levied upon its import. In the year 1909 American woolen manufactures were worth nearly $450,000,000, but the raw materials cost nearly two-thirds of that sum. Four hundred and fifty million pounds of wool were required by American mills

and we imported a little more than a third, as has long been our custom. Seventy million pounds of wool are also reused in making shoddy. The declining importance of wool is indicated by the fact that the woolen mills used 110 million pounds of cotton, which we are becoming more and more skillful in mixing with wool.

Worsted, Carpets and Hats.—Worsted, the manufacture of which was first introduced into this country about 1860, had become so popular as outer clothing by both men and women by 1900 that its production exceeded that of all the woolens combined. This lead is increasing, stimulated by the scarcity of high grade wools. In avoiding this difficulty, the woolen manufacturers are learning how to use some of the coarse wools for the worsted goods.

Wool is important in carpet manufacture, but only inferior carpets are made of pure wool. The better ones, such as Wilton, Axminster, and even Brussels have a strong web of linen or hemp into which the wool is woven. Philadelphia has long been noted as the great carpet manufacturing center of the United States and although the carpet industry there is steadily growing, the increase of carpet mills in some northeastern cities has caused Philadelphia's share of carpet manufacture to decline from nearly a half to about two-fifths.

The leading import of carpets into America is from Constantinople where the Turkish and Persian rugs, the best carpets in the world, are gathered for shipment. These valuable products, borne by caravan from the oases and villages of the remote interior, are the product of pasture and flocks highly condensed by the slow laborious hand labor of a domestic manufacture which, it should be noted, is turning out a better and more highly prized product than the western factories with their mechanically perfect goods.

Hats are classed with wool manufactures, but they are made chiefly of felting rather than weaving, the usual material being the hair of rabbits and other fur-bearing animals, the fur of the beaver being used for the finer "top" hats. This branch of the American woolen industry amounts to nearly $40,000,000 a year, of which one-half is paid for the furs. Hat manufacturing is chiefly centered in the district between Connecticut and Philadelphia,

with the New Jersey cities in the vicinity of New York gi' the leadership to their state.

Transportation and Import of Wool.—The high value of ' causes the cost of transportation to be but a small percen of the total cost of the wool bale at the mill, so that the plac production has but little influence upon the place of manufact This is even more conspicuous in the case of wool than with less valuable cotton. Our chief wool-producing districts west of the Mississippi River. The diverse requirements of di ent mills give us very scattered sources for our imports. best wools—known as Class 1—are used for making the fi cloths and are chiefly the product of merino sheep. Our su of these comes almost entirely from Australasia, the Argen Republic and the states west of the Mississippi River. Cl wool, sometimes known as worsted wool, coarser than No. chiefly home grown and from districts east of the Missis River. Of the small import of this class England supplies greater quantity. Our heaviest importation is in Class 3 w usually known as carpet wools, of which we buy more tha the other two combined. These are the coarse, harsh w produced in countries where breeds of sheep are unimproved the flocks ill-cared for. China, with the product from Mongolia, leads in the supply of this grade, largely exported f Tientsin. Other sources of important supply being south Ru Turkey (both Asiatic and European), and Scotland, where hardy highland sheep, braving the storms of his moun heather pasture, produces a coarse wool little used in Eng manufacture, but well suited to certain American carpet facto An extreme instance of the tendency of wool to make journeys is shown by Australasia, the largest wool producer the producer of the best wool in the world. It exports ninet twentieths of the wool it produces, sends it half-way round world to west Europe and the United States, and then buys b chiefly from Britain, $5,000,000 worth of woolen manufactur

The Limitation of Raw Materials.—Wool is scarce and get scarcer with small prospect of adequate increase of supply meet increasing population. Wool is a by-product of the n industry, so the conditions of the wool manufacturing can affect the raw material supply so directly as cotton manufactu

can affect its raw material, which is a product grown for its own sake. A 25 per cent. increase in the price of wool, say from twenty to twenty-five cents per pound, amounts to twenty or thirty cents' increase in income per sheep per year—a factor of small importance. A similar increase in cotton, from ten to twelve and one-half cents, changes the entire basis of the business and causes great increase of output.[1] The cotton and wool industries have, therefore, fared very differently in the past twenty-five years. While cotton production and manufacture have been going up by leaps and bounds, the production of raw wool throughout the world has increased but little, and has at times remained stationary or even declined. As a result, cotton has been substituted for many of its uses. If the process of substituting other fibers for wool does not continue we are likely to have much higher prices for wool, because of the large amount of land needed to produce it.

The industrial awakening of China and Japan, and their adoption of western ideas and methods, will increase rather than diminish the world scarcity of wool. China is now exporting her small crop of wool because the native styles of clothing can be supplied by cotton and silk, chiefly cotton. European styles demand wool, and Japan with practically no wool supply is beginning to import and manufacture some foreign wool. The adoption of western styles of clothing by modernized China may be expected to produce a similar result in that country, as it has already done to some extent in India, which now imports $10,000,000 worth of wool and makes nearly $2,000,000 worth. These oriental changes of style are likely to be permanent in contrast to the seasonal changes that beset the world of clothing, especially woolen clothing.

The woolen industry is one peculiarly subject to the influences of style. A large part of the woolen cloth is used for external clothing and when the styles in women's dresses suddenly require 6 yards as in 1912, where they previously required 12, it makes dull business and gloom in wool-manufacturing towns of Britain and in the fine wool-growing districts of the southern hemisphere.

[1] The cotton grown to meet the new demand would be on the market in a year or even less, while the wool resulting from a desire to increase the output would have to await the maturity of animals yet unborn.

4. SUBSTITUTES FOR SHEEP'S WOOL

The other animal hair fibers used for fabric seem destined continue in very secondary place—as the alpaca wool with resulting fabric, the camel's hair with its fabric, the Cashm goat's hair with its fabric. Certain coarse felts are made of co hair, but the uses for such fabric are limited and most of the l that might be obtained is unused. The Mohair, fleece of Angora goat, native of the province of Angora in central Minor, shows well the process of invention and substitution. main use is for plush, as for car seats, but of late it has been u to make imitation fur of such reality that detection is diffic In this capacity it has furnished the coat of the well-kn Teddy bear. All of the minor animal substitutes for wool insignificant in comparison to the greatest substitute of a cotton.

5. MINOR ANIMAL HAIR PRODUCTS

In the last quarter of the nineteenth century, hair cloth wa vogue especially for furniture covering. It is a smooth, bl shiny, clean, cool fabric made from the manes and tails of hor Hair cloth still has many uses, but this hair is now chiefly used mattresses, for which purpose it is curled. The bristly hai the pig is used for many kinds of brushes and the bristles th selves come in large quantities from China where the patienc the low wage workers prepares them for market. The so hairs of the badger's coat make shaving brushes and the softer camel's hair supplies us with fine paint brushes.

6. SILK

How Silk Is Procured.—Hundreds of species of insects cocoons in which to pass the chrysalis period of their lives. of these insects, a moth, most commonly spoken of as the worm, makes a particularly fine cocoon, the fiber of which call silk. The process of spinning is very similar to that by wl the spider makes its web, except that the silk worm winds thread around and around itself, as a result of which it ca easily unwound if the worm is killed—as it may be by roastir

before it cuts the thread by eating a hole in the end of the cocoon to emerge as an adult moth. The fibers are so fine that five are required for fine thread, and ordinary silk thread has ten to twenty fibers. The cocoons are soaked to loosen the fiber, the ends of several strands are placed together and the several cocoons easily unwound to make the thread of raw silk. This laborious process adds greatly to the cost of silk, which is ever the product of much labor.

The favorite and chief food of the commercial silk worm is the leaf of the white mulberry, a tree which will grow in the tropics and in the temperate zones as far as the grape extends, so that natural conditions for silk production are good in much of Europe, a large part of the United States, as well as some large part of every other continent. The successful prosecution of the industry, however, requires a second crop of leaves upon the tree and this requires a temperature of 54.5° F. for at least three months. Owing to the great amount of labor involved, the distribution of the production of silk, however, depends not upon climatic conditions, but upon the labor supply, which must be both abundant and highly skilled.

The Raising of Silk Worms.—The eggs of the adult moth are carefully collected; and upon hatching, the voracious young worms are kept in a house upon trays which must be kept clean through the weeks during which the greedy worm devours his daily portion of fresh mulberry leaves, brought in at daylight, mostly by women and children. The worm can endure less cold than the mulberry tree, so the worms are kept in heated rooms in Europe and also in parts of China and Japan. Humidity and temperature must be closely watched or epidemics may carry the worms to a speedy death. When the worms have reached adult size, they crawl into bundles of straw to spin the cocoons which the women pick out by hand. Throughout the whole life history of this insect and in the preparation of the fiber, the labor must not only be cheap, but careful, patient, watchful, and deft of hand. It thus becomes an industry that thrives where the labor of women and children is cheap, as in the densely peopled parts of the old world. It is easy to understand why the various attempts at silk growing in the United States have failed, despite the many baskets of sample cocoons that have been produced,

and despite the great anticipations that accompanied
ing of thousands of mulberry trees which have thriven

Oriental Silk Production.—The production of silk to this labor factor so surely, that the industry is re itself in accordance to it. The forcible opening up of (the modernizing of Japan, and the development of transport facili opened the silk growers of the wo Oriental competition. France a have been growing silk for cent governments are aiding the silk all they can, but their silk gro Oriental competition and the ou begun to decline, the Europea 1906–07 averaging 12.8 million po that of 1909–10, 10.5 million During this period, the Orienta increased from 28 million to 3 pounds per year. The greatest ducing region is China, where it is hold industry of the peasants between 30 and 35° north latitu corresponds roughly to the Yangt a region whose silk output makes it olis, Shanghai, the world's gre market. Canton in south China considerable silk center with n filatures employing 500 persons Yunnan, southwest China, there i of sericulture spreading the kno silk production so that the people a substitute crop for the forbidd which has been so important th various parts of the country, sev moths produce a marketable kind of silk, so that one-fi Chinese silk is known as wild silk.

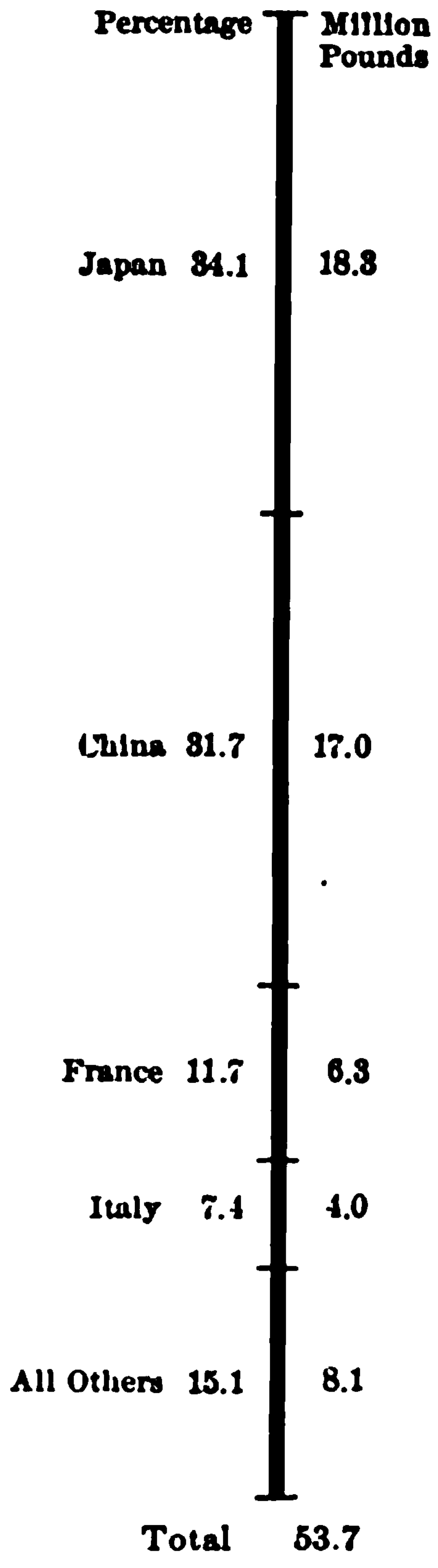


FIG. 174. — Production of raw silk, three-year average, 1908–10.

Japanese Silk Production.—Silk growing is very i in Japan, and this people, being more forward than the in the use of scientific devices, adopted filatures, or ma

unwinding the cocoons and preparing the raw silk of commerce. The Japanese silk export has increased more rapidly, therefore, than the Chinese export, with the result that the Chinese are now adopting the new method of preparing it.

Silk is particularly suited to the conditions that prevail in Japan. The monsoon rains of summer give the moisture needed to make the mulberry trees yield abundant growth of leaves. The small proportion (less than a sixth) of the land that can be cultivated leaves abundant room on the hillside for the mulberry trees and the overcrowded population furnishes the labor. It is natural, therefore, that this opportunity should, in a land of scanty raw materials, be eagerly seized upon, as shown by a 50 per cent. increase in the export of raw silk within five years, 1906–1910. The Japanese export of silk is equal to the entire world production of silk as statistically reported[1] for the five-year period 1876–80 and its value, $65,000,000, comprised 28.5 per cent. of Japan's export and in total amount was greater than the entire exports of Japan two decades before.

Silk in India and West Asia.—Early attempts at introducing silk culture in India have led to a considerable production for local use, but the export has never been important nor does it under present conditions promise to be. From India westward the climate of Asia is arid, with dense populations centered here and there where some mountain slope produces sufficient rainfall, as in the small area of Persia between the Elburz Mountains and the Caspian Sea. Here some silk is produced for home use and export, as is also the case in a small district on the south slope of the Caucasus Mountains in the Russian province of Trans-Caucasia. Certain densely peopled valleys of Asia Minor and Syria also contribute a little to the world's supply, but none of these regions seem able to offer or promise serious competition with Japan and China. Their labor conditions are not the equal of those of the orient and they lack the abundant possibilities of tree growth.

The Commerce in Silk and Its Production in Europe.—For centuries silk was the mainstay of commerce between the Far East and the Mediterranean world, and the Chinese jealously prevented the export of silk moth's eggs. However, according

[1] Domestic consumption of the orient excluded.

to legend, an enterprising traveller finally broke the embargo and carried some away in a hollow bamboo walking stick, so that in the sixth century A. D., the growth of silk worms become common in Greece, southern Italy, and Spain. In all of these districts the amount produced is now negligible, because the small amount of arable land is given over to crops with a richer harvest than mulberry leaves. But silk has become very important in northern Italy where, upon the level plains of the Po, three-fourths of the European silk crop is produced. Here a traveller may never see an open field for miles, because of the rows of mulberry trees, bare in early summer, because leaves have been stripped for the silk worms during their seven weeks of rapid growth in the springtime. The intensity of Italian agriculture is attested by the fact that while wheat and other grains are grown between these rows of mulberry trees, the trees themselves are so trimmed that each tree holds out its two branches as arms to its neighbors and upon these outstretched arms grape vines are often trained. Thus three crops are obtained from the same land.

During the mediæval prosperity of the Italian city republics, Bologna, Lucca, and other cities of north Italy were famed for their silk manufactures, and in 1515, when Francis the First of France conquered Milan, he introduced Italian silk workers into France. They established the silk-manufacturing industry at Lyons and the cultivation of silk in the valley of the Rhone, where there are now 114,000 silk growers. For a long time it was more important here than in Italy, but the greater density of Italian population in the Po Valley in recent decades has given that district the leadership in European silk production.

Pasteur and the Silk-worm Disease.—Silk-worm production affords a fine example of the dependence of industry upon science. In 1853 a silk-worm disease appeared in the Rhone Valley and threatened the silk industry of the world, as the phylloxera later did the grape industry. The French scientist, Pasteur, at the order of the French government, investigated the silk-worm disease and found that, by the use of the microscope, he could detect the healthy insects. Only the healthy were permitted to lay eggs and thus a sound generation of worms was produced. The French silk industry, which had

clined 90 per cent. between 1853 and 1876, again steadily creased for thirty years.

Comparison of Transportation and Labor Factors.—Since the nsportation cost is unimportant in silk production, labor is e determining factor in locating the business. The peasant o produces $3.50 worth of wheat must deal with the problem paying freight on 200 pounds of freight, more or less. If he oduces $3.50 worth of raw silk he has to pay freight on only pound. A freight rate of 3 cents per pound is about 1 per nt. on the silk and the same freight is from 150 to 200 per nt. on wheat valuation. The freight is, therefore, an almost gligible factor in sending silk half-way around the world from e place with the most desirable conditions for the production raw silk to the place with the most desirable conditions for its nufacture. It is easy to understand why the United States, e country with the greatest silk manufacture, does not produce bale of the raw material.

Silk Manufacture in Foreign Countries.—Silk fabrics have ng been more largely used in China and Japan than in any her part of the world. Some of the hand-made fabrics are of ost excellent quality, but, owing to the relative superiority of hinese and Japanese in the production of raw silk, and to the fluence of western tariffs, the oriental exports of fabrics have en limited to small amounts, and they are chiefly of the inferior ods made by the newly introduced western machinery. During the nineteenth century, France has been the great leader nong the nations of the world in the manufacture of silk, the nter of the industry being in Lyons, in the raw silk-producing ction. The Jacquard loom which was invented there early the nineteenth century produced figured brocades of great auty and excellence, and French brocades became famous herever ladies dressed in Parisian style. Toward the end of e nineteenth century, the ease of sewing made possible by wing machines and the rapid communication established by il and telegraph, caused fashion in ladies' dressing to change rapidly that a valuable French brocade which would last r years would long outlast the style. Hence, the preference was for less expensive, less durable, but equally beautiful brics. These the Germans and the Swiss, with their policy

of pleasing their foreign customers, promptly suppli prosperity of Lyons waned and it took years of depı convince the manufacturers of that city that their s too good for the market. They have recently begun tc with their eastern neighbors in t facture of the poorer goods desir swiftly changing market, and t output in 1910 amounted to $8 The Swiss silk manufacturers are through many towns, but Zuri chief center of the manufacture and at Basel, just across the Swi ary in Germany, is a great ribb facturing center with the large mill in the world. The German s try is like many other industri country, rapidly increasing and itself of the teachings of science by its manufacture of artificial si discussed later).

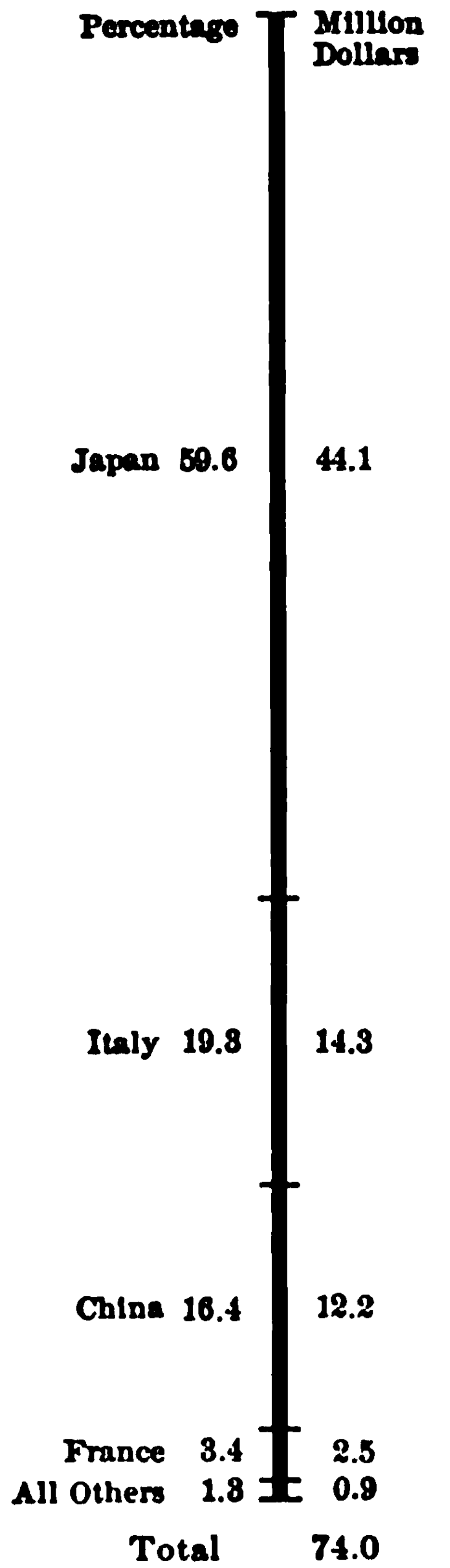


FIG. 175.—United States imports of raw silk, three-year average, 1909–11.

British Silk Industry.—The silk in England is peculiarly unimpor nation so great in textile mar England's early lead in cotton w cated by the similar early success in silk manufacture, which en mills of that country to compete v of England even in their own ma late years there has been some ma of cheap silk goods in the cotton districts of England, but the best used in England are imported, and number of silk employees is only a as great as that in the United Sta

Silk Manufacture in the United States.—The Fren facturers have had to meet (in the American markets) competition of the American silk manufacture, w increased with great rapidity from an output of $1 in 1870 to $103,000,000 in 1905 and $196,000,000 in 19

has supplied about five-sixths of our consumption and has held the import for some years at a fairly constant though large figure. Over half of the total value of silk production is expended for the raw silk which costs nearly $3 a pound and is furnished to the United States as follows: Japan nearly two-thirds, China one-fifth, Italy one-seventh, France one-thirtieth.

STATISTICS OF AMERICAN SILK TRADE

Country	Imports (1911) into United States			Exports (1911)
	Raw silk		Mfg. silk	Silk mfgs. from U. S.
	Amt. in lbs.	Value		
Japan	14,013,000	$47,336,600	$ 5,056,000	....
Chinese Empire	6,294,000	14,057,400	486,600	....
Italy	2,948,800	10,264,000	1,095,700	....
France	1,560,000	2,013,900	18,250,000	....
Switzerland	....	....	4,975,000	....
United Kingdom	....	....	4,039,000	$200,500
Germany	....	....	6,311,000	....
Canada	....	....	31,500	915,800
Total	26,666,100	$74,998,300	$41,746,800	$1,569,400

Our exports of silk manufactures are quite negligible and the rodigious increase of our production is due largely to the estriction of the market by a protective tariff and to the rapidly ising standard of consumption in America. Every device that ermits the cheapening of silk goods places them within the each of an ever-widening circle of purchasers. There is every rospect of continued increase in the American silk industry, and f continued dependence upon foreign lands for the raw material. Ve will certainly not produce the raw material and we may expect icreased demand for the goods, for every general increase in urchasing power places more people in a position to use this rized luxury.

Relation of Silk Manufacture to Other Industries.—Silk manufacture is comparatively light work, and the percentage of women operatives in the silk mills is higher than in any other branch of textiles. This predominance of women gives the silk mill a tendency to be what is sometimes called a "parasitic industry"; that is, it is located because of the presence of other industries which employ large numbers of men, so that the wives and daughters of the workmen make a labor supply which encourages the creation of silk mills. Thus Paterson, N. J., an important place for the manufacture of various classes of iron goods, which employ only men, has long been the most important silk-manufacturing town in the United States, having produced over a quarter of the total silk product in 1890 and about a fifth in 1905. This relation of the silk to heavy industries is well shown in Pennsylvania, where the silk mills are located chiefly in and near the coal-mining towns, especially Scranton and Wilkesbarre, and the cement-manufacturing towns of Allentown and Easton in the Lehigh Valley, and in the agricultural implement-manufacturing town of York, and more recently in the coal and iron region of western Pennsylvania. Silk manufacturing has not made great headway in New England outside of Connecticut, which is also an important state in the manufacture of machinery and metal goods. In order of value of output, New Jersey ranks first, Pennsylvania second, and New York third, but industrially, the cities of northern New Jersey are suburbs of New York and the New York-New Jersey silk district may be considered as one. It is thus to be seen that with the near-by mills of Connecticut and Pennsylvania, silk manufacture is the most concentrated of all our important textile industries.

Artificial Silk.—The silk worm makes silk by drawing the fine threads from a jelly-like mass in its head. This material is made from the cells in the worm's vegetable food, as changed by the chemistry of its body. Man has copied the worm's process. By chemical process of the laboratory, saw dust or cotton waste may be converted into a jelly much like that from which the caterpillar makes his silk. By air pressure this cellulose is driven through very small apertures in glass. Each aperture makes filaments so small that, as with silk, it takes ten to twenty of them reeled together to make a thread. This process which began in

has spread to Germany and Switzerland, England and a, and the output is increasing with a suggestive speed. 9, the output was 3 million pounds, and in 1911, it was ion or nearly a fourth as great as that of real silk. This y used 914,000 pounds in 1909 and imported twice that wo years later. The price, which is declining, was $1.70 nd, while that of real silk was $2.80 per pound. At first l silk was used for woof or weft threads only, but of late een used for warp also. Its chief use to date has been for and trimmings, for which because of its superior luster it lly preferred. It should be noted that this most suggest-r, now in its infancy, is made now chiefly from cotton, an nt raw material.

icial lace and artificial silk tulle of high quality, especially for women's hats, have been successfully made by g cellulose of the kind from which the artificial silk is U. S. Con. Rep., July 17, 1911). These new products of will apparently give cheap silk to the masses. It is too tell whether or not they will displace real silk.

7. THE PLANT STALK FIBERS

iinery has revolutionized the textile industry by giving ways to produce its old results. It has revolutionized it giving the new seed fiber, cotton, in place of the stalk nen, and it holds the possibility of further revolution by is yet other cheap stalk fibers. Of plant stalk fibers there ny. Practically all the larger plants have some form of them. Several thousand plants have stalk fibers which ood quality for textile use if they could be secured in cheap nce, and several dozen such fibers are actually in exten-in various parts of the world. This group of fibers is of n antiquity and because of gin-cheapened cotton, it has y been of less relative importance to man in the century 912 than in any century for many centuries. It has splaced for the time being, but there is no guarantee of tinuance of cotton's leadership in plant fibers. Some ber cheapened by machinery may compete with it, but present the plant stalk fibers with all their superiorities tton are at low ebb.

Flax and Its Preparation.—Flax is now, as in the past, the n important plant stalk fiber entering into our clothing. ' plant, a member of the nettle family, has been yielding linen s the pre-historic Lake dwellers inhabitated the Swiss lakes, the mummies, bound up in linen cloth, were placed in the Eg ian tombs four or five thousand years ago. Before the inven of the cotton gin, the common stinging nettle was much use Europe as a substitute for flax. In 1790 when cotton was used in manufacture than China grass or ramie is now, flax the most important of all vegetable fibers. It was grow almost every European and American farm, and in many ar American home the implements for the preparation of flax still to be found. The introduction of cheap cotton ca flax to disappear from gardens at about the time of the pas of the spinning wheel and the hand loom.

The plant is somewhat branching, but otherwise resembles small cereals in appearance and method of cultivation. For it must be pulled, piled up to dry, and the seed removed wit iron comb; then the straw is "retted,"—a process of partial d to make easy the separation of fiber. In some places it is re in bunches, spread upon the ground of moist meadows; in ot as in Ireland, it is immersed in water. In Belgium, where a s flax industry still survives, the water of the river Leys is o culiar fitness in retting flax, and in it the straw is immersed i few days' time, then dried, subjected to two more wettings, du which it decomposes and is ready for the "breaking." Th accomplished by running the straw through rollers, after w the scrutching or separation of the fiber is accomplished, so times by hand, sometimes by running the straw through a mac with dull knives. Fibers thus obtained are from 8 to 50 inch length, and are strong and durable, but the labor, coming at busy season of a farming year, has made the method impractic wherever wages were high and import of commercial prod easy.

Flax is unquestionably superior to cotton for many uses, from the standpoint of competition on the point of cost, it under yet other handicaps. Although flax grows in a far w range of climate than cotton, it is much more easily injure drought or wet weather and the difficulty of preparing it

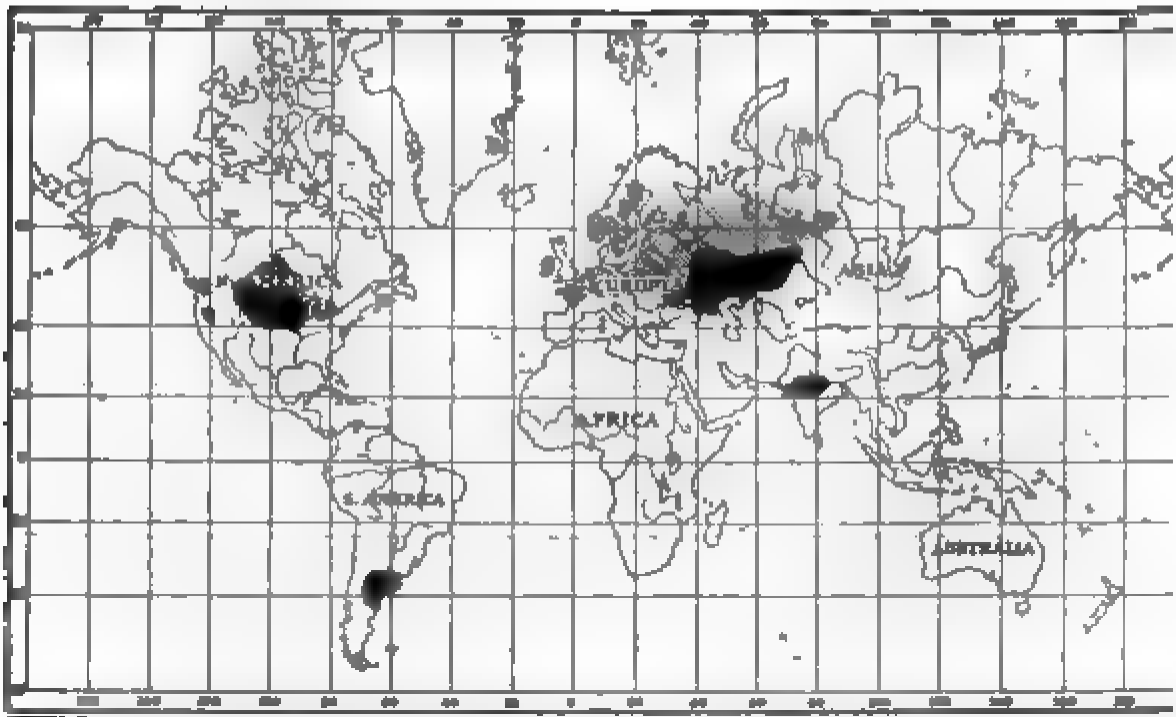
lack of uniformity, a serious handicap to the manufacturer. The fiber is impregnated with pectose, so that it is more difficult than cotton to manufacture. It requires more power and more labor. Machinery has increased the linen spinner's efficiency only about one-half as much as it has the cotton spinner's efficiency.

The Distribution of the Flax and Linen Industries.—Scotland and the north of Ireland, long important centers of flax growing, now have a greatly reduced production, but the manufactures that developed from the local flax still persist in increased quantity. Some flax of excellent quality is produced in the Po Valley of northern Italy, but the great part of the world's supply is now produced in northern Russia where labor is cheaper than in any other part of Europe suited to flax growing. The manufacture of flax into linen is so important in the United Kingdom that more than $40,000,000 worth of flax products are annually imported, and 100,000 people are employed. The north of Ireland, (especially near Belfast) and the south of Scotland, which a century ago grew flax and manufactured it in hand looms, now are the centers of the world's finest factory operated linen manufactures, excellent illustrations of the influences of an early start as the basis for an industry. In Germany the linen manufactures of Westphalia are famed, as are also those of Bohemia and of Belgium. Linen manufacture has thus far been exotic in the United States, and is of small amount, but a fraction of the import, which amounted to $18,000,000 in 1911. We do not produce the finest grades of cloth nor the thread from which we produce the small amount of cloth now made. Collar and cuff manufacturing is one of the most important American industries using linen, and this branch of manufacture shows a most astonishing concentration in the city of Troy, New York, where nine-tenths of the entire product of the United States is made. This concentration is best explained by the fact that, if a new collar and cuff factory is to be established, the best place in which to find labor already trained for the work is in the city of Troy.[1]

The Range of the Flax Plant and the Flax-seed Industry.—While flax produces a valuable seed (linseed) the plants grown for

[1] It is stated that the wife of a Troy blacksmith first made shirts with detachable collars about seventy-five years ago and that a Methodist minister encouraged this home industry. See R. H. Whitbeck, *Journal of Geography*, Oct., 1909.

fiber are pulled before they blossom so that flax fiber district have no valuable by-product of seed as is the case with cotto growing. Flax thus gives rise to two industries, one, fiber, th other, grain. The plant has an exceedingly wide range, havin produced good fiber all over the eastern United States and Euroр from Scotland, Sweden, and Russia to Italy. It is now in cultiv tion from Algeria to Archangel, the present great center of fib production. The flax fiber crop requires a fertile soil with a co



Cultivated primarily for seed production, straw not used for fiber except limited extent in Russia and Siberia.

Cultivated primarily for fiber; straw used for fiber and seed for oil, except Ireland where seed is usually not saved.

Fig. 176.—Distribution of flax in cultivation. (Original by Lyster Dewey.)

moist climate. The southern part of the Russian flax fib district has the latitude of Winnipeg, thereby suggesting gre flax areas in Canada.

For seed it will do well in warmer dryer climates and poor soils. While the fiber is grown in Europe, the seed crop is grow in America, Africa, and India. The cultivation of the flax plan like silk culture, shows fine responses to labor conditions—densi of population. Varieties producing poor fiber but fine seed a grown in several of the important wheat regions, as the Argenti Republic (one-third of the world's crop), Central Russia (on fifth of the world's crop), the winter wheat belt of the Red Riv

of the north United States and adjacent districts (one-fourth of the world's crop) and northern India (one-eighth of the world's crop). In all these districts, with a total crop of 100 million bushels, flax is, from the agricultural standpoint, not a fiber but a cereal planted like wheat, harvested with the most improved reaping machinery, threshed by steam, and handled in every respect like wheat with no thought of saving the fiber that is in the straw. Indeed, the straw is often burned. The laborious hand processes in sparsely peopled countries like Dakota and Argentina are entirely impossible, but fit well into the scanty opportunities of north Russia.

The seed, upon being crushed, yields linseed oil, much used for making paints and varnishes. The "oil-cake" that remains is highly valued as food for livestock, and is shipped in thousands of tons from Dakota by way of New York, Montreal, Boston and Philadelphia to feed the herds of dairy cows in Holland, Denmark, and England. The oil itself is a raw material for the paint factories of Philadelphia and other eastern American cities and is used wherever the painter climbs his ladder.

A Possible Revolution in Linen.—By a recently perfected process it is claimed that much of the old and laborious process of preparing flax fiber can be entirely avoided by a speedy mechanical operation which may be likened to the threshing of wheat, or the ginning of cotton, and which extracts the fiber from flax straw in a few hours. Unfortunately the long fibers are broken into lengths of less than an inch. This must weaken the fabric and limit its uses, but a Massachusetts factory has been built for its preparation and manufacture and it suggests great re-adjustments due to the competition of cheap flax produced upon the world's frontier grain fields and sold at a much lower price than the cotton which is yet expensively picked by human fingers and sold at ten to fifteen cents a pound. The success of the cotton picking machine and the flax decorticator, if both should come into use, will enable mankind to reap the benefit of the great industrial race to the fabric market—a cheapened clothing supply. If plant breeders set themselves to the task there is good reason to think that varieties of flax can be produced capable of yielding both seed and fiber.

Hemp.—Hemp, the fiber of common cordage, is closely allied

to flax, of which it is really but a coarser variety and therefore fitted for coarser uses. It is used in almost every rope factory in the United States and Europe. The fiber is separated from the stalk by processes similar to those used in flax preparation. It grows in the same kind of climate, being produced to a small extent in Kentucky, in the north of Ireland, in Scotland, in north Italy, to a small extent on the low alluvial lands of Lincolnshire, England, and to much the greatest extent in the flax districts of northern Russia whence comes the bulk of the world's supply.

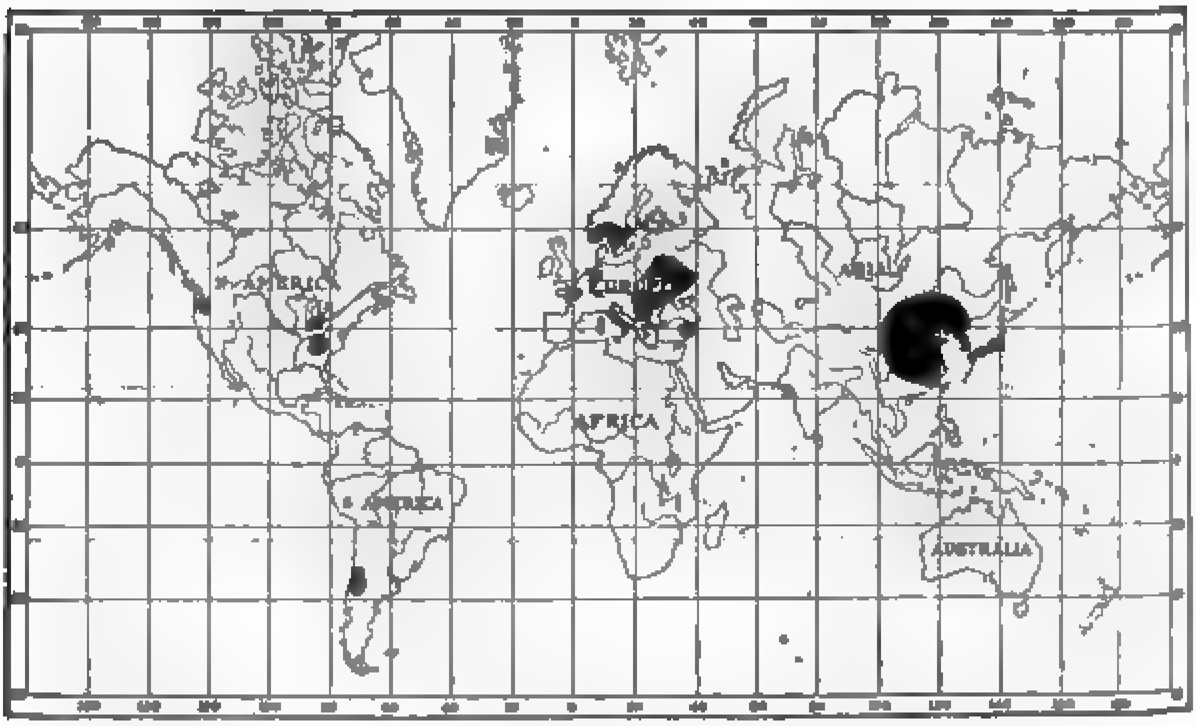


FIG. 177.—Distribution of hemp in cultivation. (Original by Lyster Dewey.)

The American hemp district in the Bluegrass section of Kentucky has for a long time had a declining output due to the competition of cheaper labor in other hemp-growing countries, but especially through the competition of cheap jute. Due to this influence, our present hemp import of about six thousand tons is but a quarter as great as the imports of 1880. Recently, after a long series of failures, a hemp-breaking machine has been invented and while it is too soon for its ultimate results to be indicated, it is causing the large-scale growth of hemp in northern Indiana. The growers of Kentucky, after a life-long series of disappointments with hemp machines, are slow to adopt the improvement, although the self-rake reaper is rapidly replacing the old hand-used hemp hook.

Jute, the Fiber for Cheapest of All Fabrics.—This fiber is produced by two species of plants which will grow in many tropical countries, yet they are cultivated to a commercial extent almost exclusively in northern and eastern Bengal near Calcutta, where, along the periodically overflowing Ganges, there is the right combination of tropical climate, flooded land, and abundant labor. While adapted to all soils, most of the product is grown on the overflow land near rivers because the plants easily stand flooding. Like flax, hemp, and many other fibers that are not gummy, it is separated from the stalk by being soaked in water. After the bark is stripped off by hand, the plant tissue is washed away by beating the plant upon the surface of the water in which the laborer stands.

Jute has been long used in India where common gunny sack was first produced by hand looms. In 1835 the manufacture was taken up in Dundee, Scotland. The origin of this industry in that city is an interesting example of the chance location of industries. In the eighteenth century epoch of hand-loom textiles the vicinity of Dundee was famed for its good flax which its people made into linen. After the removal of the source of flax supply to Russia, the Dundee weavers began to import and manufacture some hemp which was grown in these new flax districts and which differed so little from flax that for some uses the two fibers were rivals. Then some hemp came from India, and with it the other Indian fiber, jute, which bore the same relation to hemp that hemp did to flax. As a result, Dundee established a jute industry in which it had for a long time a monoply in the entire western world. By way of Liverpool and London, it exported and yet exports large quantities of gunny sacks, the cheapest of all strong fabrics—to America for the shipment of wheat and corn and the covering of cotton bales; to Brazil for coffee sacks, to Argentina for wheat sacks; and to Australia for wool bales. During the latter part of the nineteenth century, jute mills were established in other linen manufacturing centers of the United Kingdom, on the continent, in Calcutta itself, and also in Boston and Philadelphia. Calcutta is now the greatest center of manufacture, with total exports of raw and finished products amounting to $100,000,000—a greater addition to the wealth of India than the silk industry of the United States is to this country.

The lustre of well-prepared jute makes it possible to mix it with silk for silk manufacture and it is also used to some extent in the carpet mills of Philadelphia and many other cities. We are importing from 60,000 to 100,000 tons of it per year and it costs less than four cents a pound delivered in America.

Minor Fibers Called Hemp.—Several fibers rendering service similar to that of hemp have, upon their appearance in the world market, been called hemp regardless of their origin. Among these are sun hemp and deccani hemp, much used in India. Both are fibers from the inner bark of plants. In parts of New Zealand and adjacent islands the people cut two or three times a year a wild plant resembling the flag, to secure its fiber—the New Zealand hemp or phorium of commerce. This fiber is exported to Europe and, to a limited extent, to the United States, to be used for the same purpose as hemp. But its extensive use is prevented by the fact that it is difficult to remove the fiber from the gummy substance of the leaf. The New Zealand government has recently offered a bonus of $58,400 to the inventor of a machine that will successfully decorticate this fiber.

Manila hemp, the best of common rope materials, is not hemp at all, but a coarse fiber sometimes 8 to 10 feet long, found in the pithy stalk of the abaca, a fruitless member of the banana family. This plant grows wild in the Philippines and the almost uninhabitated Molucca Islands, but is cultivated only in the Philippines. It thrives best on the moist slopes of volcanic hills in a moist climate, but it will not do well in water-soaked or very dry soil. This plant conspires with the climate to keep the Filipino from steady work. Man does not usually like to work regularly and it is often not necessary in the productive climate in which fortune has placed the Filipino. He can from time to time plant a few suckers of the abaca plant, and in two or three years he can cut them down, split them into strips a couple of inches wide, scrape away the pulp with a sharp knife and sell the long, white, shiny fiber to travelling Chinese merchants, who gather it up and take it to Manila. They pay sufficient cash to meet the small financial needs of the tropic family for a few days or weeks until pressing need makes it desirable to scrape a little more fiber. Attempts at introducing Manila hemp grow-

ing into other parts of the world have thus far failed, and it is practically a monopoly of the Philippines, where there is a great abundance of admirable, unused abaca land. The fiber has been much the most important export from these eastern possessions of the United States, and is shipped from Manila, Hong Kong, and Singapore to London, Liverpool, New York, Philadelphia, and San Francisco. It makes the strongest of rope, which is especially prized in the rigging of ships, and when worn out for this use it is ground up to make the exceedingly strong paper known as Manila. It is also much used for the manufacture of twine used in binding up the bundles of wheat in self-binding reapers, for which purpose approximately $20,000,000 a year are expended in the United States for twine made of Manila hemp, and of its cheaper rival the sisal or henequin, which is the great money crop of Yucatan. In 1907 the abaca furnished 60 per cent. of the exports of the Philippines, but in 1911 a fairly constant export had become but 33 per cent. with copra 29 per cent. and sugar 25 per cent. crowding it for first place. In this country the use of Manila, costing 5.8 cents per pound (1911), is increasing more slowly than sisal, costing 5.1 cents per pound (1911).

The rise of the henequin or sisal grass industry is due solely to the invention of a machine which effectively extracts the fibers from the long, fleshy, spiny leaves. The henequin, an agave, close kin of the century plant, is a plant of the arid land, doing well in dry, spongy soils, particularly if they are limestone. It requires no cultivation other than the occasional chopping down of rival plants, and yields an annual harvest for from six to twenty-five years. It is produced to some extent upon the limestone soils of the Bahamas, but the great center of shipment of this product is the port of Progreso, in Yucatan, from which railroads radiate over the semi-arid limestone plain. This region is so honeycombed with caves that there are no surface streams. It produces no money crop but the sisal, and at times an insufficient quantity of supply crops, of which corn is the chief. In years of crop shortage the sisal growers import corn from the United States in considerable quantities as food for both man and beast. Turks Island in the West Indies, which somewhat resembles Yucatan in soil and climate, also exports a little henequin; and it had been successfully introduced into Cuba, Hawaii,

German, and British East Africa, and India, so that there may be possible re-adjustments in the supply of this fiber when Eastern and Western labor come into full competition. Inasmuch as this fiber requires the semi-arid tropics and the tropics are bounded by deserts, it is plain that there are two strips of land encircling the globe in which sisal districts may be found. Hawaii with dry lands on the leeward side of her islands has one sisal plantation of 1,100 acres, regular exports, and expects the fiber to be one of her leading exports. It is suggestive of the trend toward vegetable fibers, that in a period of generally rising prices, the prices of imported sisal and Manila have dropped between 1907 and 1911 from 7.5 cents to 5.1 cents per pound for sisal,[1] and from 9.9 cents to 5.8 cents for Manila.

Other Mexican Fibers.—The plateaus of northern Mexico are so dry that the people have considerable difficulty in growing enough wheat, corn, and beans to feed themselves on this rather low diet, but here, as in Yucatan, the aridity furnishes a money crop. Another member of the agave family supplies an export in the istle fiber, used to some extent for cheap cordage. A third member of the agave family, the well-known century plant, is cultivated in Mexico as a fiber plant to yield the pita fiber of commerce.

Coconut Fiber.—The coconut, widely distributed along the tropic seashore, contributes to commerce the well-known hard-shelled nut, the dried coconut meat known as copra, and lastly the coir fiber, a part of the thick and spongy husk which protects the nut from bursting when it falls from its great height to the ground. By soaking the husk in water, the pithy packing between the fibers can be washed out by hand or by machinery, leaving the stiff fibers which are used for making brushes and ropes very durable in sea water, and the coarse, strong cocoa matting so often used upon the floors of public buildings.

Matting.—The ordinary matting used as floor covering is practically all exported through Hong Kong. It is largely produced in the adjacent parts of China, but it is also a native product of the adjacent Tonquin or French Indo China. The

[1] The dependence of one industry upon another and of the automobile upon prosperity is shown by the decline of automobiles in Merida the metropolis of Yucatan (pop. 62,000) the sisal state, from over 200 when sisal was high, to 40 after the price declined.

farmers grow a special kind of straw for the manufacture of this characteristic tropic floor covering.

Ramie or China Grass.—The best of plant fibers is that known as rhea in India, ramie in Malay countries, and China grass in many other parts of the world. It is twice as strong as the best Russian hemp. It excels all other fibers in its resistance to the influence of water, and is used to make sails for racing yachts, where expense is no consideration. In appearance it rivals silk. It may be used for a host of purposes from the ship's cable and sail cloth to velvet or lace. It is much worn as summer clothing in China, and factories produce fabric from it in England and other European countries. In comparison to cotton the climatic range of the plant is wonderful. It thrives in the torrid zone and as far north as Normandy, where it is grown to a limited extent. It will thrive in many parts of the United States, is grown commercially in Mexico, but chiefly in China. The reason this wonderful fiber has not been extensively used is the great difficulty thus far experienced in separating it from the stalk of the plant in which it grows, and from the gummy substances which adhere to it. As with hemp, many announcements of a successful decorticator have been made, and success in this line holds the possibility of a revolution in the world's clothing, cordage, and fiber industries. Cheap ramie, grown almost anywhere and decorticated by a machine, may, in combination with cheap flax, give unthought of competition to cotton even if picked by machinery.

New Fibers and Process.—The probability of changes in the textile world which will enable us to meet our needs from cheaper sources is indicated by three recent inventions now in the experimental stage. In Germany paper yarn cloth is being made in qualities that are reported to be easily fireproofed, well suited to upholstery and curtains and possibly for some clothing purposes. In England a process has been devised for making cloth from the fiber of Posidonia Australia, a seaweed of the southern seas from which it is estimated that the fibers can be prepared for the spinner at two cents per pound. From Austria comes the account of a method of extracting a jute-like fiber of good quality from ordinary straw by a process of boiling which suggests the process by which we have taken wood, digested it by

boiling it in chemicals, thereby extracting the fiber which serves us in the manifold uses of paper.

The possibility of fiber from paper, straw, seaweed, ramie, and mechanically-won flax offer suggestive vistas of conjecture. (U. S. Con. Rep., Feb. 12, Mar. 23, and May 16, 1912).

8. CLOTHING

Similar Development of the Textile and Clothing Industries.—At the end of a century and a quarter of machine manufacture and world commerce, the making of clothing is now passing through an evolution similar to that which has occurred in the textile industries. The cloth was at first made in the homes of the workers from materials which were given out on contract. Later the whole work was done in the large factory with the aid of machinery. Some clothing is now made by the old domestic system, some on contract in the homes of the workers, and some in factories and shops. The supplying of sailor's clothing was the start of the ready-made clothing industry. In 1850 the sewing machine opened great possibilities, which led to the widespread establishment of the industry in 1861–65, when the Civil War demanded ready-made clothing for millions of absent men. In the latter quarter of the nineteenth century, the industry spread and located itself in the great cities. Great abuses arose through the "sweat shop," home work in crowded apartments, often at very low wages. In recent years legislation, aided by the invention of factory machinery, has partly broken up the "sweat shop" system and factories now make clothing more cheaply than can the most diligent workers toiling in their own homes at any fair wage. The first decade of this century was, as a consequence, a period of rapid increase in the manufacture of men's and women's ready-made clothing in factories rather than in sweat shops. In the sweat shop five persons usually work on a coat, each doing a particular part. In some of the great factories, as many as a hundred persons work on each coat, and the total amount of time required to produce a given output has been reduced to one-third or even to one-tenth of that previously required before the introduction of the greater division of labor, new cutting machines, and the electric-driven sewing machines.

Why It is a City Industry.—Clothing manufacture belongs to large cities because of the double advantage of nearness to market and to labor. It is an advantage to be near the center where the product is sold, and the successful selling of ready-made clothing requires a market where vast numbers of persons are supplied, so that, by the law of averages, all of each of the many sizes of clothing may be called for. As the market widens it permits the finer and finer subdivision of the sizes, and the greater possibility of an exact fit for each person. The large city also possesses the labor which is so large a factor in this industry in which the transport of the raw material is so easy. The manufacture of clothing is concentrated to an astonishing but declining degree in the city of New York, the greatest distributing center of the United States, where it is the leading industry, with an output valued at nearly half a billion dollars per year and equal to that of all the other cities of the country. Chicago is second, Philadelphia third, Baltimore fourth, Cincinnati fifth, Rochester sixth, and Boston and St. Louis next in order. This great predominance of New York is due in large part to the unusual labor condition that exists because it is the chief place for the landing of the new immigrant. Tens of thousands of these people know nothing of the language and little of the country, and they are accustomed to low wages and inexpensive standards of life. The clothing factory, where each person does a small operation, offers these helpless ones an opportunity to acquire in a few days the skill to make a better wage than they had in Europe. The industry in all the American centers is usually carried on by foreign-born persons newly arrived in this country. The standardizing of clothing is steadily advancing and with it new additions to the list of manufactured articles. Children's and women's clothes,

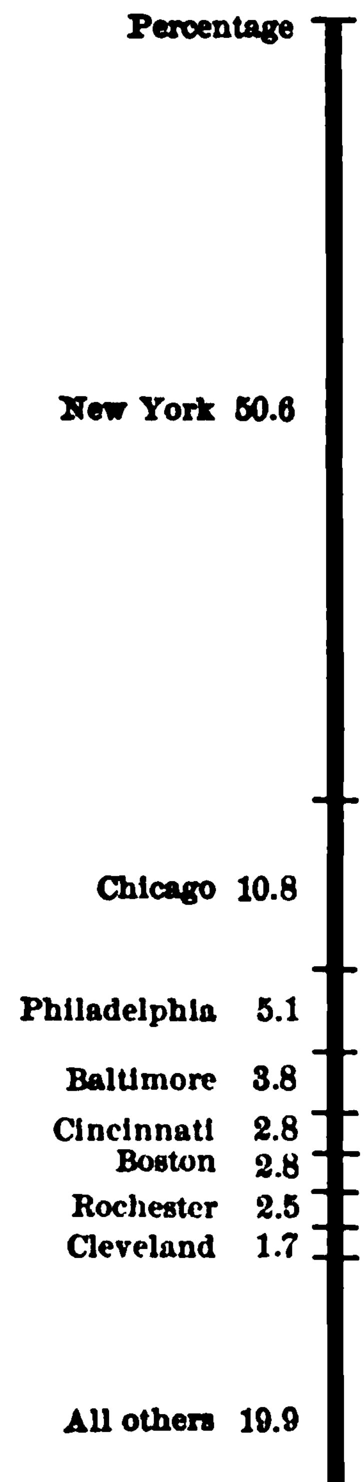


FIG. 178.—United States clothing manufacture by cities, 1905.

such as shirt waists, which a few years ago were made to measure at home or in the tailor and milliner shops, are now turned out by thousands in factories. The small tailor is also suffering from the competition of the great factory through the competition of made-to-measure mail-order business. By this innovation, a country merchant in Texas shows a book of samples to a customer, measures him, and the suit is made in a New York, Rochester or Chicago factory.

Clothing Manufacture in the Old World.—The use of ready-made clothing is less general in Europe than America, chiefly because the lower wages make it less necessary to use machinery. In Great Britain, London occupies a position similar to that of New York, and the work is there done in the poorer or eastern end of that city by newly arrived immigrants of the same races of people who do the work in New York and Chicago. The only difference to point out in London and some large Continental cities is the greater proportion of sweat shops and the smaller proportion of factory workers as compared to American cities. But factory-made clothing is steadily advancing, as evidenced by the recent opening of a factory in Barcelona, Spain, with 1,600 workers, using American sewing machines electrically driven.

The increase in the use of ready-made clothing seems certain to increase, for it is attacking the market at the bottom and at the top. The people of Jerusalem, Constantinople, and Quito are reported as purchasing cheap hats, coats, and working clothes of European manufacture—Austrian, German, British, French. At the other end of the market is the well-known American advance in the quality and sale of factory-made clothes.

Manufacturing of clothing is increasing in the wool-manufacturing cities of Yorkshire. Factories here export the product to the British colonies and also make up clothing upon the specifications of tailors living in other localities. The people of Guatemala, for example, find that they can get suits made to measure in England and delivered by parcels post for only $2 more than it costs at home.

It is interesting to note that as Japan's industrial evolution advances along Western lines, a factory-made clothing industry begins to develop there also.

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CHAPTER XIII

LEATHER AND RUBBER

1. LEATHER, RAW MATERIALS, AND MANUFACTURE

Antiquity and Distribution of Leather.—Leather is made by cleaning and treating skins so that they will keep, and the skins are furnished by a great variety of animals. Naturally the domestic animals—the ox, sheep, goat, horse, and pig[1]—lead, but many other animals contribute their small quota to the world's leather. Among these are the alligator and crocodile, the manatee, or sea cow of tropical rivers, the monkey, the serpents, and the wolves. The skin of man himself is at times converted into excellent leather, and the white whale of the Arctic Sea yields a strong and water-tight skin called porpoise hide. With this great variety of sources, practically every trading people sends some kind of skins to the world's market, and even among the lowest savages skins are the chief riches.

Leather is as old as trade and the industry contributes to the commerce of every nation and every people, sometimes in the form of hides and of raw materials for tanning, sometimes as finished leather, which is the raw material of shoe factories and other leather works, and, finally, in the form of shoes and other leather manufactures.

The Trade in Hides and Skins.—The term hides is applied to the skins of cattle and horses; skins, to those from sheep, goats, and smaller animals. The United States leads all other countries in the manufacture of leather, and although the meat of animals is one of our greatest exports, the import of hides and skins, amounting to nearly $100,000,000 a year, is one of the greatest items of our import trade. Practically every country in the world contributes some of these raw materials. Of goat skins alone we import over a hundred million a year, their

[1] The difficulty of curing pork after it is skinned causes us to lose a large leather resource estimated at $3,000,000 per year in Britain alone.

alue is equal to that of the cattle hides and they come chiefly rom India (32 per cent.), China (15 per cent.), Mexico (9 per ent.), Brazil (7 per cent.), Morocco, and South Africa, all of which countries have the arid conditions in which the goat hrives better than any other domestic animal. The hides of attle come largely from the Argentine Republic (34 per cent.), great cattle range like our own western plains, and from the Canadian and Mexican (12 per cent.) extensions of the American lains and plateaus comes another large part of our hide supply. We also draw by forwarding from United Kingdom, France, and Germany, and from every country in Central and South America. Because dried or salted ox hides, proof against rain, dirt, and blows, baled in any size or form, carried by any means, are one f the safest and most convenient commodities that can be arried over rough and difficult pack trails. The raw hides xport much more easily than leather and the lack of industrial development in those countries makes tanning impossible here. In addition to the importation of hides from the rough, he arid, the poor, and the undeveloped countries, which annot tan, we also get them from the richest and greatest manufacturing nations in the world—England, Germany, France and Russia—where the fuller utilization of resource, due to a dense population, has produced a scarcity of tanning materials n which the United States is the richest country in the world.

The Tanning Process and Materials.—Tanning usually consists in treating the skin with a strong astringent, tannin, a very common vegetable substance which unites with certain elements in the hide and changes it from a material prone to decay to one of great durability. Tannin, like sugar, is widely distributed among plants and is found in workable quantities in all continents. Its usefulness in tanning seems to have been discovered independently, long ago, in many parts of the world. [illegible] found the American Indians with leather of excellent [illegible] and about the only people who do not know how to [illegible] the central African tribes south of the Soudan.

Until a half century ago, the peoples of Europe and America depended for tanning almost entirely upon the bark of oak in southern, and hemlock in northern, locations. The growing scarcity of [illegible] and the increased supply of hides which

world commerce produced, has created a lively trade in other tannin-producing materials, so that now no less than fifty of them are in use. With the increase in transport, there is a growing tendency to ship these materials in concentrated forms, thus lessening transportation costs. The concentrates were formerly made only in tanning factories where used, but now they are to a greater extent made near the centers of production. Thus the oak bark which England imported from Holland, Belgium, Austro-Hungary, and Italy contained from 10 to 12 per cent. of tannin, while the concentrated form now shipped has about 30 per cent. The oak wood itself, which has from 2 to 5 per cent. of tannin, contributes its share through extraction from saw dust and waste scraps yielded by the saw mills of Hungary and Italy. In central Europe tannin is also extracted from the bark of Norway spruce for shipment to the tanners of England and Germany.

England gets from India another tanning material known as myrobolans, the dried fruit of a leguminous tree growing abundantly in the region of Agras and central India and furnishing the chief tanning material of that large country.

Sumac is a shrub or small tree growing wild in Austria and the Balkan States of Europe and in the Appalachian region of the United States. In Sicily, it is cultivated for its leaves, which, from the standpoint of the producer, are a crop not unlike hay, being regularly cut and dried, and shipped to the tanneries powdered and in sacks. Some wild sumac is gathered in Virginia and other Appalachian districts of eastern United States, but competition of other tannin materials and the rise of wages in Appalachia have checked for a time the American sumac industry. The Sicilian sumac industry fits well into the industrial conditions of that overpopulated island. The plant grows without tillage on land too dry and rough for other crops, and it affords employment when other work fails and other crops do not need attention.

Valonia, a rich tannin material, is nothing more than the acorn cups of the valonia oak, picked up by women and children in the forests of Turkey, Asia Minor, and the Balkan Mountains, and shipped to England where it has largely replaced the use of oak bark now so scarce in that country.

Australia exports the bark of the black wattle tree, a member of the acacia family, with bark yielding as much as 40 per cent. tannin, this making it the richest of all tanning materials. In Natal this tree is planted for its rich harvest of bark which it yields in from five to twelve years.

The most important development in the tannin-extract industries is the rapid increase in the production of quebracho extract in the Argentine Republic. The quebracho tree (the name means axe breaker), is a medium-sized tree with a very hard wood containing 20 per cent. or more of tannin which renders the wood almost indestructible in the ground, thus making it very valuable for railroad ties. Its richness in tannin has caused a rapid increase in the shipment of the extract to the tanneries of England, Germany, and the United States, over 80 million pounds now being used annually in this country. There is a great supply of quebracho in the Argentine Republic, as it seems to be found throughout a large part of Gran Chaco—an extensive, unsettled tropical forest in the northeastern part of that country. One company here employs 30,000 workmen and also raises cattle, a fact that indicates the destruction of the forests. Since the wood is heavier than water and is very difficult to get and transport, the extracting plants are, like saw mills, located as near as possible to the place where the trees are cut. When used alone the quebracho extract makes inferior leather, but in combination with other materials, its results pass in world's commerce.

In the Mediterranean countries, where the chestnut is common, this wood is furnishing an extract, and the same industry has recently been established in the Appalachian districts of the United States. While this wood is much poorer in tannin than quebracho, it is light and soft, grows in open forests and is vastly easier to get to the mill than the heavy tropical wood. The chestnut tree increases in tannin content with age, and in America, at least, with lower latitudes. In New York the tannin content is about 4 per cent., in southern Pennsylvania about 6 per cent., at Lynchburg, Va., about 12 per cent., in Tennessee, 14 per cent., and even higher in north Georgia. After the chestnut has been cut to bits and the tannin digested out of it the pulp that remains is used for the manufacture of low-grade paper.

The imports of tanning materials into Germany, the greatest

importer of these materials, show well the widely scattered origins of tannin.

GERMAN IMPORTS OF TANNING MATERIALS, 1910

Extracts	Tons
Oak, pine, and chestnut	29,076.7
Whereof from France	19,251.8
Quebracho	9,742.9
Sumac	629.2
Quebracho and other woods	141,060.8
Algarobilla and bablah (from Chile)	481.7
Dividivi (from Colombia and Venezuela)	6,696.8
Myrobolan (from India)	17,578.1
Acorn cups, galls, and valonia (chiefly from Asiatic Turkey)	24,092.8
Gallnuts (chiefly from China)	3,123.6

The United States, with its large domestic supplies, imports a small quantity of tanning materials.

The Making of Leather.—The United States makes over $300,000,000 worth of leather per year. The industry, which gives employment to 50,000 people, is one that has had greater changes in material than method. The common method is to put layers of bark between the hides and then soak in water while the tannin does the work. The supply of oak bark, which was the chief dependence of Europe until 1850, lasted longer in the United States, because of our great forest resources, so that the forest with its bulky bark located the American tanning industry down to the end of the nineteenth century. The valuable hides and leather were easily portable. Tanneries were small affairs like the little country grist mill, and were scattered in rural hamlets and mountain valleys throughout Appalachia and New England. Hundreds of thousands of acres of oak and hemlock forests were bought by tanners who cut down millions of good trees simply to strip them of their bark and let the logs rot because bark could be carried from rough nooks whence it was unprofitable to move the logs, and bark could be used in localities where there was no market for such a bulky commodity as lumber. The tanners often kept a team busy hauling hides and leather to and from some port, as Alexandria, Baltimore, or Richmond.

Since 1870 we have had a remarkable diminution in the number of leather-manufacturing establishments, six-sevenths of the total having disappeared. The old tannery has followed the country grist mill. Many an Appalachian county that once had five or ten tanneries, now has none. But the capital invested in tanning has increased four fold since 1870 and the value of the product has increased 60 per cent. Bark tanneries are still dependent upon the location of forests, but the building of railways has made it economical to carry bark by rail to a large tannery rather than to have many small tanneries away from the railroad. We have, therefore, two bark-tanning belts, one reaching the whole length of the Appalachian Mountains from New York to Georgia and including Virginia on the east and Tennessee on the west, the other in the hemlock region running from Massachusetts to Wisconsin, both of which are important leather states.

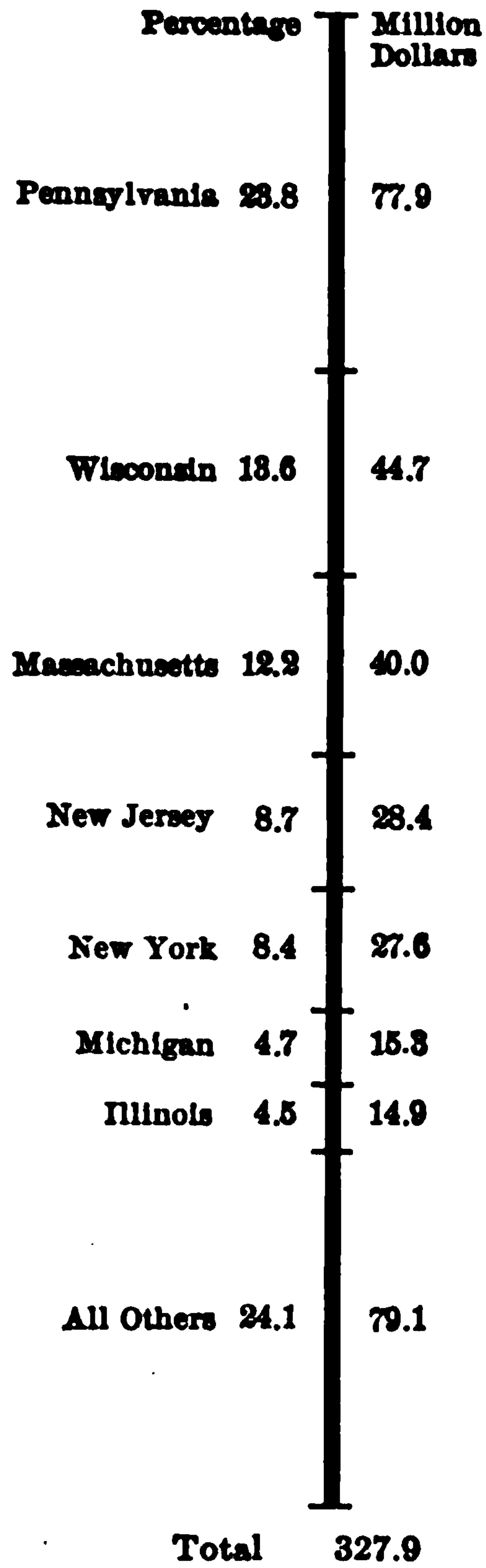

FIG. 179.—Leather tanned, cured and finished in United States, 1909.

Chemical Tanning and Its Effects.—Fortunately for the forest resources of the United States and the world, a new tanning industry has arisen practically independent of wood materials because it depends upon chemical compounds of chromium. This chrome process was first developed in Philadelphia, where it has grown with great rapidity and helped to make that city the greatest leather-manufacturing center in the world. The chrome leather industry, depending on factory products, labor, and markets, tends to locate in manufacturing centers rather than forest districts and since it depends almost entirely upon imported goat skins for its raw material, there is some advantage in being near the ports of entry.

While still importing small quantities ($5,000,000 in 1911)

of special European makes, the United States is doubling its leather export ($40,000,000 in 1911) every ten years. Two factors explain our leather export. One is the forest for the unrivalled bark-tanned sole leather. The other factor is the new chrome process, particularly in connection with several patented processes for leathers of especial finish such as glazed, enamel, patent, and vici kid. The bark is a natural monopoly, the new processes are covered by patents. Thus we have the unusual spectacle of raw materials forwarded to us via Hamburg and Marseilles and Liverpool, and the finished product sent back to the same countries. France takes one-sixteenth, Germany one-eight of our leather export, and the United Kingdom nearly one-half of it including three-fourths of our sole leather and two-fifths of our glazed kid. Japan is also an importer of American leather.

Leather Making in Europe.—Germany is the greatest leather-manufacturing country in Europe, the German specialty being colored leathers. Among the European nations France is next to Germany, and each of those countries exports twice as much leather as does Great Britain. British imports of leather (nearly $50,000,000) are the largest in the world and she also imports some hides for tanning. England buys nearly all of her hides from India, which country (with more cattle than any other) is even beginning to export leather as well as hides to the mother country. In France, as in Holland, Belgium, and parts of Germany, we see in the leather industry an interesting adjustment to the density of population. The scarcity of forests long ago caused the establishment of willow plantations so trimmed as to grow long slender twigs for weaving the baskets that replace the boxes and barrels used in this country for the shipment of agricultural and manufactured products. These same basket willows yield a bark suitable for tanning a leather especially adapted for glove making. The dense population of France, Germany, and Belgium gives the labor supply to turn these good leathers into a large glove output. The position of Paris in the world of style enables France to lead all other countries in the export of gloves, of which vast quantities are sent to both England and the United States. Germany, however, is rapidly gaining on France as a glove maker and exporter. Russia still manu-

factures, at the city of Kazan, the famous Russian leather with its peculiar odor due to the oils of the birch bark in which it is tanned. Morocco is the name applied to a special variety of goat-skin leather first made in Morocco and then introduced into Cordova, Spain, where it gave that country great fame in the world's leather market. But both of these are now relatively unimportant because of the much greater production of this kind of leather (leathers bearing the same name) in Alsace, France, and in Philadelphia. Morocco is still unexcelled in the fine quality of its leathers made in many colors, each hue the result of some particular vegetable tannin.

Scattered Local Leather Industry.—There is some leather produced in almost every country of the world, because it is a simple manufacture which almost any people can carry on to a limited extent for home use. Leather is thus produced in the interior of Colombia near Bogota, in Mexico and central Asia. About the only leather export from the southern hemisphere is that from Australia and a little from the German settlements in the forest regions of southern Chile, where good sole leather is made.

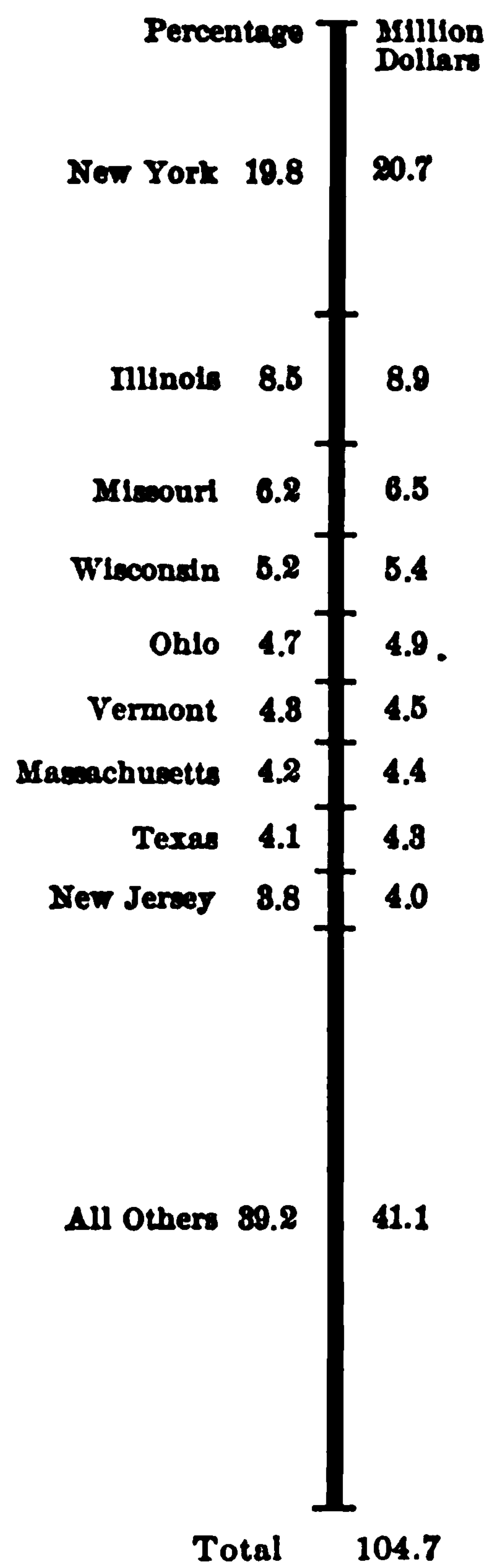

FIG. 180.—Leather goods other than shoes manufactured in the United States, 1909.

2. Leather Manufactures.—Leather manufactures included belting for driving machinery, harness, and finishings for carriages and automobiles. It is also used for a host of small trinkets and many industrial purposes, but the making of boots and shoes is much the most important use.

The Old and New Systems of Shoe Making.—During the first half of the nineteenth century the shoemaker, with his kit upon his back, was an annual visitor to thousands of households in the eastern United States where one or two tanned hides awaited

his coming to be converted into the family shoe supply for the ensuing year. The wandering shoemaker competed with the local shoemaker who had his shop beside the country store and had his regular customers as the physician had his patients. The old order is rapidly passing away before the development of the shoe factory, which, during the last quarter of the nineteenth century, began to roll out shoes through the aid of very complex machinery and a minute division of labor in which dozens, sometimes scores, of persons worked on each shoe. This division of labor and factory manufacture gave the industrial center an advantage over the skilled shoemaker and has caused his almost entire disappearance, despite the superior wearing quality of his product. The passing of the roadside shop was followed by a surprising concentration of manufacture. The state of Massachusetts produces three times as many shoes as any other state. The two cities of Brockton and Lynn together produce about as many shoes as any two states outside of Massachusetts, while Haverhill, Marlboro, and Boston are other important shoe centers. Manchester, New Hampshire, and Auburn, Maine, are really a part of the same shoe district, which sends shoes to every state in the Union and to many foreign countries. The shoe factories of these New England towns use soles stripped from Texas cattle in Chicago slaughter houses tanned in Tennessee with Appalachian chestnut oak. The upper parts of the shoes are usually made of imported goat skins tanned in Philadelphia. The shoe industry of the United States employs 220,000 people and produces 250 million pairs per year (1909) worth over $500,000,000 of which about two-thirds is the cost of the expensive raw materials. As with the ready-made clothing, so with ready-made shoes, a wide market and large sale make possible the production of a great variety of shapes and sizes so that greater and greater numbers of people can be fitted with the factory product. This factor in combination with the great cheapness of machine in comparison to hand output, helps to explain the great and quick concentration of the industry.

The Foreign Trade in Shoes.—Shoe machinery, developed in the United States, brought the product up to the point where the machine-made shoe would fit a large proportion of the people. As a result, American shoe exports, of which the greater number

go chiefly to Cuba (one-fourth), Great Britain, Mexico, and Canada, are now of more value than those of any other country, having recently surpassed those of England. The total, however, amounts to the comparatively small number of 6 or 7 million pairs of shoes per year. The superior fit and comfort of American shoes is appreciated and a few years ago a large trade seemed to be in prospect, but the export of American shoe machinery to Europe has been followed by the ability of Europe to compete in the one respect in which they were lacking—style. This in combination with preferential tariffs has cut down the American shoe export to New Zealand six-sevenths in six years. The world's commerce in shoes is much less important than that in any other form of clothing. In this connection, the tropic habit of going barefoot should not be overlooked. Shoes are almost unthought of by races that buy cottons by the million yards. Many nations that buy nearly all their cotton and woolen goods make nearly all their shoes. Then too, styles differ, styles change, and man wants a shoe to fit his foot and the style.

Tendency of Shoe Industry to Spread.—High freight rates and the heavy expense of shipping a valuable commodity like shoes make it advantageous for every large distributing center to have its own shoe factories. This helps to explain the advance of St. Louis, between 1900 and 1905, to the third shoe center of the United States, and the advance of shoe manufacturing in Rochester, New York, Cincinnati and Columbus, Ohio, these cities being nearer to the western markets and practically as accessible to the source of raw materials. The shoe industry in St. Louis was established by the aid of Massachusetts foremen taken thither at extra large wages.

Glove Manufacturing in the United States.—While many fine gloves come from France, Germany, and England, there is a production, chiefly for home use, of something like $20,000,000 worth in this country. The glove industry is remarkably concentrated, the two towns of Gloversville and Johnstown, in Fulton County, New York, neither of which has 20,000 people, make nearly half of the gloves in the United States. There appears to be no reason for this other than that more than a century ago some Scotch people, members of the Scotch glove-makers guild, settled here and the house and village industry

has been handed down from generation to generation until the sewing machine and the factory made it possible for these cities that had the start to maintain the leadership in this branch of manufacture, for which they have no natural advantage over a thousand other towns.

Harness and Saddles.—The English people have for centuries been the greatest lovers and breeders of horses in the world, and it is quite natural that harness and saddles should be exported from this more than from any other country. In general it may be said that harness making is an industry that tends to be located in cities and small towns everywhere in the United States and Europe, no great centers having yet arisen.

The Future Supply of Leather.—There is no sign of any diminution in the demand for leather. As standards of living rise, the people of Holland, Belgium, and Germany tend to lay aside wooden shoes, as do the Chinese and Japanese their leatherless foot gear of straw, cotton and wood. But leather is rising in price because it depends on animals and animals are now becoming relatively scarce. The world does not possess the leather to make western shoes for the Chinese. In the United States, which draws upon the world, the number of hides and skins used increased 16 per cent. between 1899 and 1909 and their cost increased 59 per cent. Leather substitutes should be welcomed.

The Origin and Utilization of Rubber.—While primitive man long ago learned to use the tannin from many plants, the rubber that many other plants contain had to wait for the modern man with his laboratory.

The coagulation of the sap of trees into a sticky or gummy substance is a familiar occurrence on many of our common trees including some of the conifers and fruit trees. Similar milky, coagulated sap of many tropic trees produces the chemically complex substance we call rubber. For eighty years after 1736, when the attention of Europe was first called to it, its only use was as the eraser; hence the name "rubber," for which extremely small quantities sufficed. In 1823, a Scotchman, named MacIntosh, used caoutchouc or rubber to waterproof cloth (which yet bears his name), but in hot weather the gum got sticky and in cold weather it grew brittle and broke. In 1842, Goodyear,

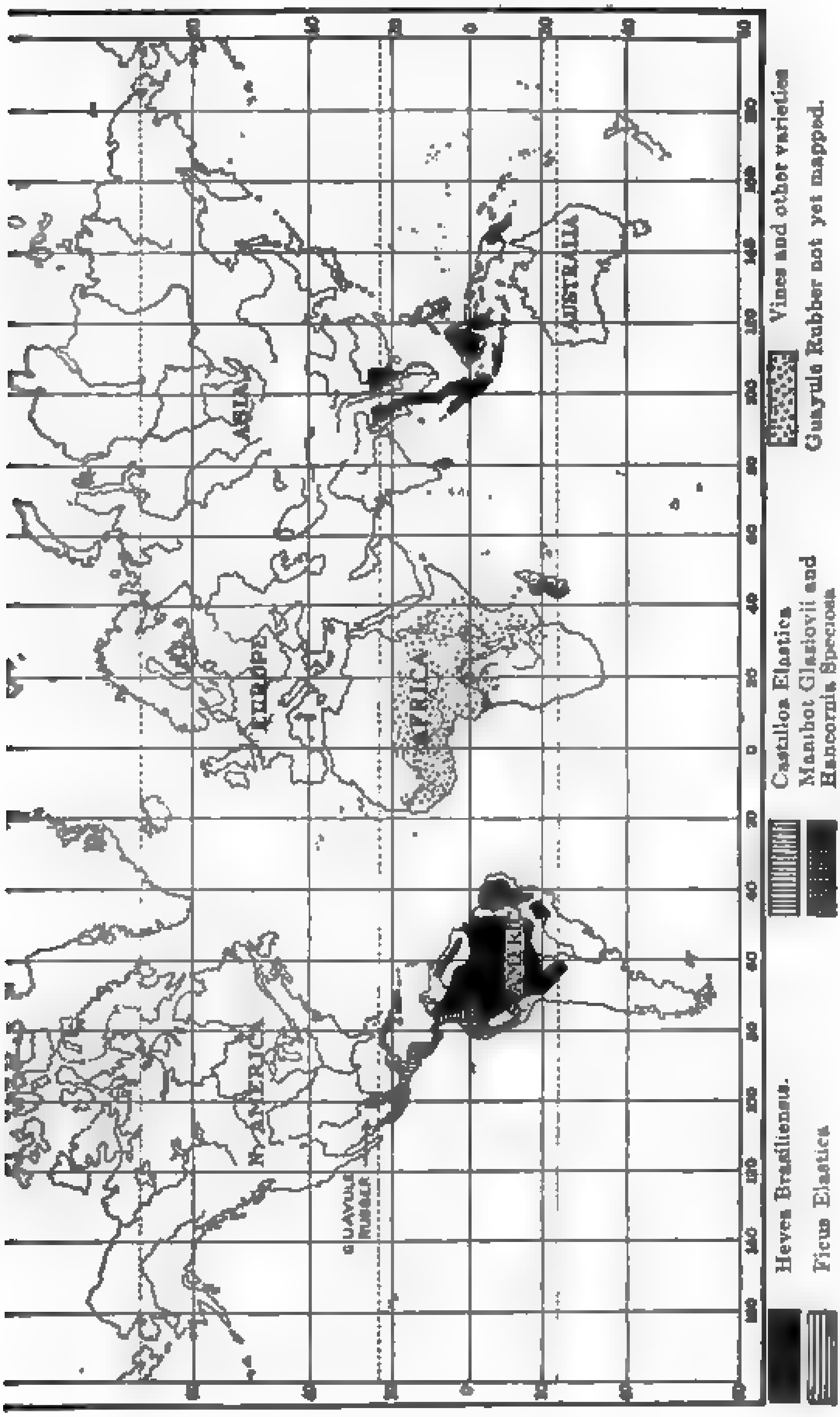

FIG. 181.—Distribution of leading varieties of rubber plant. (From A. Vincent Industries du Caoutchoric et de l'amiante.)

an American, discovered that the process of vulcanizing, or mixing rubber with sulphur, remedied these faults and gave it the qualities so suitable for waterproof clothing, shoes, and boots. A large percentage of sulphur makes the hard rubber used for combs and a great variety of electrical and industrial articles.

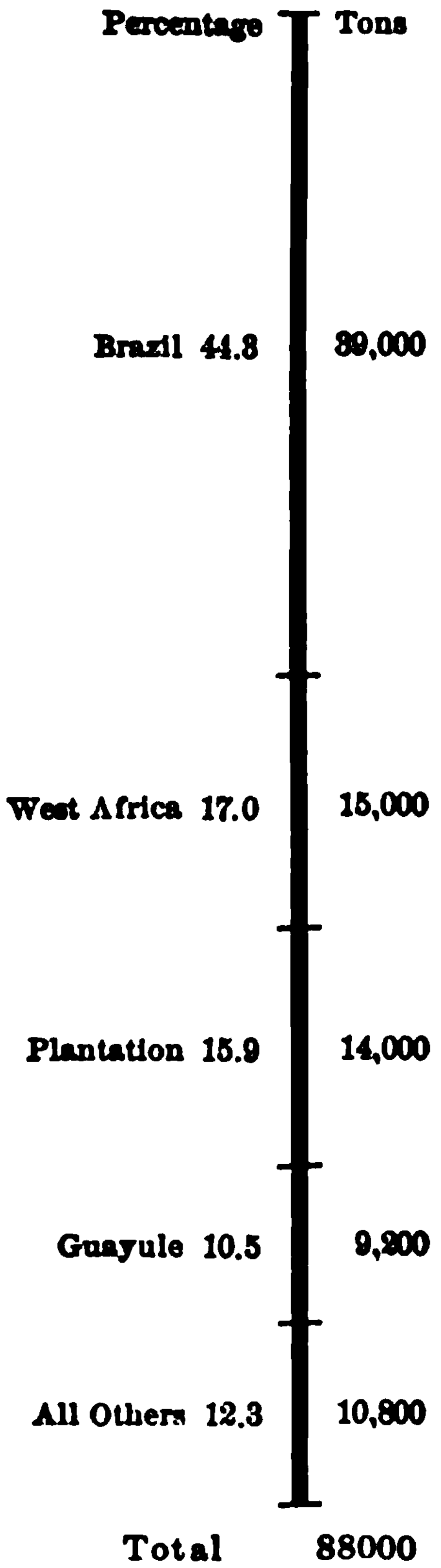

FIG. 182.—World's production of rubber, 1911. (India Rubber World.)

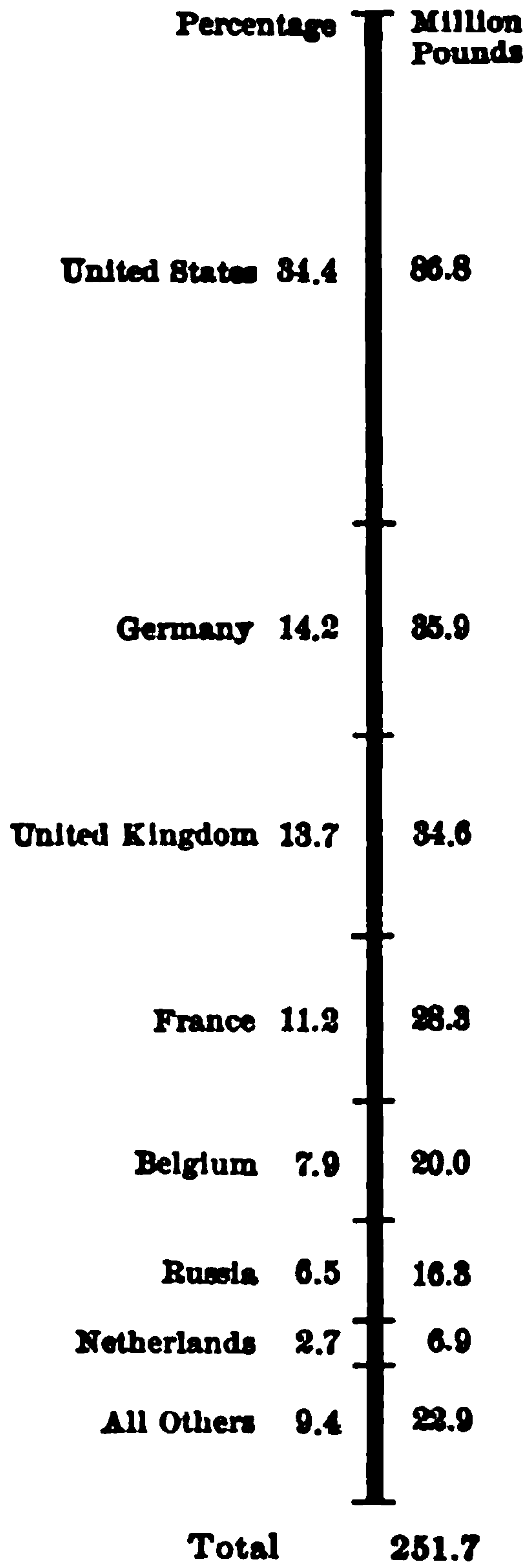

FIG. 183.—World's india rubber import, three-year average, 1908-10.

The Recent Increase in Rubber Consumption.—Goodyear's invention started the rubber boot and shoe industry which has for half a century supplied what was considered at first a luxury for the well-to-do. Now they are a common necessity so that their manufacture in the United States now amounts to about

ne-tenth the value of the leather boots and shoes. The import f crude rubber and gums has gone up rapidly from 5,000 tons n 1870 to 17,000 tons in 1891 and 72,000 tons in 1911; of india ubber alone we import 50,000 tons. About the year 1890, ubber consumption entered upon a period of great increase ue to the adoption of the pneumatic tire. The resulting sudden nd large development of the bicycle industry, to which rubber s an essential, promptly followed. A few years later came the utomobile with its still larger demand for rubber in heavy tires. There has also been steady increase in the amount of rubber used or electrical insulation and other new industrial work and the nlarged demand for raw rubber has raised its price to phenomnal figures, and caused it to be supplied by many countries where ts production had previously been almost unknown.

The Rubber Climate.—Rubber grows naturally and is proluced over a very wide area of the earth's surface. In this respect it resembles tannin. All of the commercial rubber plants with a single exception require the heat of the torrid zone, most of them require heavy rain, but some are adjusted to dry climates, so that rubber can be produced in most parts of the torrid zone where conditions permit the production of food rops. All the forested part of the tropics and some of its unorested areas thus become a potential rubber zone.

Para Rubber Region.—The rubber which for several decades as supplied half of the world's supply and set the standard of xcellence is known as Para, because it is shipped from the Brazilian city of that name at the mouth of the Amazon River. This city, practically upon the equator, is at the outlet of a alley, reaching from the Atlantic to the western wall of South merica, containing the world's largest forest and producing ubber over an area probably two-thirds as large as Europe. This rubber-yielding forest includes about half of Brazil and hose large parts of Bolivia, Peru, and Ecuador which lie east of the Andes and receive the heavy rains brought by the trade winds from the Atlantic. Colombia also has a part of her territory in this basin. Throughout the length and breadth of this enormous valley from Para to the Andes, and reaching beyond it into Venezuela and Guiana on the north and Paraguay on the outh stretches one continuous forest through which the traveler

must fight his way with knife and axe. Scattered here and there in this gloomy jungle are trees of the dozen or more varieties from which the natives gather the rubber to ship down the Amazon. Being shipped from Para, it bears the name of that city and is sometimes credited as being entirely the product of Brazil.

The only transportation facilities through this continent-filling forest are furnished by the navigable streams. The Amazon and its many branches afford altogether several thousand miles of navigable waterways—and the amount might be largely increased by the removal of trees which overhang, fall into, and choke up the smaller streams. The native and half-breed rubber gatherers have to work in a fearfully unwholesome climate in a jungle full of insects, serpents, and wild beasts. These defenceless workers, 3,000 miles inland, virtually beyond the reach of law, have of late been subjected to such barbarities in the Peruvian forests that the governments of the United States and the United Kingdom have interfered in their behalf. The greatest difficulty in gathering this rubber is to cut paths from one tree to another in the tangled jungle. A few miles back from the navigable streams the jungle shuts out man by a tangle through which he cannot afford to cut even with rubber at the unreasonably high prices of 1910.[1] For this reason the vast areas of South American forest with its sprinkling of rubber trees cannot be taken as an indication of vast yield of rubber in the future if present methods are to be followed.

After the rubber tree is found, the tapping of it is simple. The bark is cut with a knife, the sap is caught in a vessel, brought to camp and coagulated in the dense smoke of a fire made of a certain palm nut. A paddle that has been dipped in the thick sap is held in the flames and the acetic acid and creosote of the smoke cause the juice to harden into rubber. The process is repeated until a lump of rubber about the size of a man's head is formed on the paddle. It is then ready for shipment to market, where it has long been known as the best grade. Commerce in rubber and the supplying of the rubber gatherer's wants is the chief reason for the existence of Para, at the mouth of the Amazon; of Manaos, a thousand miles up the river; and

[1]For a short time it was $3 per pound.

of the little city of Iquitos in eastern Peru, to which small ocean steamers regularly ascend.

The Para Rubber Tree.—The Para rubber tree, known as the Hevea, reaches 2 or 3 feet in diameter, and 60 feet in height. It requires a rainfall of 80 to 120 inches with the full torrid temperature which ranges from 75 to 90° each day. This means, therefore, that the tree is at home in the equatorial rain belt at elevations below 2,000 feet. In the year 1876, about the time of the invention of the bicycle, the hevea was introduced into the National British Botanical Gardens at Kew, near London, and distributed thence in 1881 to India and Ceylon, where it grew and seeded. It has since been introduced and found to do well in the Malay Peninsula, Eastern India, British Burmah, Northern Queensland, the Fiji Islands, some of the West Indies, the Seychelle Islands in the Indian Ocean and the west coasts of Africa and there is good reason to believe that it will be as much at home in the forests of the equatorial Congo as in those of the equatorial Amazon.

Central American Rubber Tree.—Another kind of rubber, known as Central American, far less famed at the present time than the Para, is the product of the Castilloa tree which grows wild in the tropical forests from the Tehuantepec region of Mexico throughout the Central American countries, Panama, western Colombia, and Ecuador, to Peru. The tree grows to great size, reaching 150 feet in height and 6 to 8 feet in diameter. The usual method of the native rubber tree hunter is to cut down the tree to get all the rubber at once. By killing the tree and thus destroying the future resources, he gets several times as much as one tapping would yield, and *he* gets it, which might not be the case if he let the tree live. A tree 5 feet in diameter will yield when cut as much as 50 pounds, and there are records of a single tree in Nicaragua having yielded 350 pounds of rubber. Such a tree is an easily acquired source of income, for it is a product of nature, free to be hunted, like game, by the forest dwellers of every country from Mexico to northern Peru. It is exported in small quantities from all these countries to the United States and Europe. This tree also has been introduced to practically the same countries as the Para tree.

Asiatic Rubber Tree.—Asia has been supplying a small pro-

portion of the world's rubber, of a variety known as Assam, produced by a member of the fig family, *ficus elastica.* This tree, whose product gave us the name "india rubber," also requires heavy rain and a warm climate; and thrives naturally along the low southern slopes of the Himalaya Mountains north of Calcutta and north of the Brahmaputra River in the provinces of Sikkim and Darjeeling, and in Burmah in latitudes as far as 26 and 27° north, where the climate is much too cool for the equatorial Para rubber. It thrives also in Java and Sumatra, and has been introduced into some other parts of the world.

African Rubber.—Africa, with the largest of all tropic areas, also has many species of rubber trees and of late has increased rapidly as a rubber exporter. The Lagos rubber tree, known as the Kicksia, grows along the western coast from Liberia, just below the Sahara, to the Congo upon the equator and eastward to Uganda upon the great lakes. The rise in the value of rubber and the spread of the art of gathering it have of late caused great activity among the native African rubber hunters, and the rubber output is consequently increasing all along the coasts of the Gulf of Guinea. This product alone far outranks in value all other exports of the Belgian Congo territory, amounting to 78 per cent or $15,000,000 in 1910. Important among the many other rubber plants of tropic Africa is the Landolphia vine, a creeper climbing in great festoons to the tops of the forest trees. There are many other species of these rubber plants in both eastern and western Africa, and in Madagascar.

The Rubber Tree of Dry Regions.—One of the small states in the highland region of Brazil, near its eastern point, produces an interesting kind of rubber called Ceara, after the name of the state. The Manihot tree from which this rubber is derived grows very rapidly, attaining a height of 10 feet the first year and 30 feet the second, and is ready to tap in four years. It differs from other rubber trees in its ability to grow on a dry rocky soil which is in some cases useless for the production of food crops. The tree is even reported to survive those unusual Brazilian seasons in which there are no rains. It is the source of but a small proportion of the Brazilian rubber export, but owing to the more wholesome climate in which it will grow, it appears to have great possibilities as a rubber producer under

cultural conditions. Its culture is not, however, receiving much attention at the present time.

Guayule.—The last of the rubber plants is the unique guayule, an herbaceous plant from a few inches to 3 or 4 feet in height, growing over the prairies of northeastern Mexico and even the southwestern part of the United States, oftentimes in regions so dry that there are no forests and all ordinary agriculture must depend upon irrigation. Guayule has sprung into sudden importance since the automobile put up the price of rubber. In 1904 it was in the experimental stage and in 1911 our imports of it, entirely from Mexico, were one-fourth as great as our imports of the so-called "india rubber." The extraction of this gum, which is produced by a member of the sunflower family, differs from all the others in that the plant must be taken to large factories for the extraction, which requires large quantities of water. Two things about this rubber industry are very suggestive for the future era of rubber cultivation.

First, it is a small herbaceous plant offering the possibilities of a crop with steady returns once in eight or ten years.

Second, it grows in a region where white men can live and work. The largest factory, employing 700 men and turning out 6,000,000 pounds in 1911 is at Torreon on the Mexican plateau in the latitude of the mouth of the Rio Grande.

In the states of Durango and Cohuila land which was considered absolutely worthless and not even fit for pasture of cattle has in the last few years produced fabulous sums from the sale of Guayule shrub which rose from $5 to $50 per ton between 1904 and 1910 (U. S. Con. Rep., August 10, 1912). It thrives in a rainfall of 14 inches or even less and grows up to altitudes of 6,000 to 8,000 feet. The plant contains from 10 to 14 per cent of rubber and the cost of extraction is from ten to forty cents a pound.

The Shifting Source of Our Rubber Supply.—The present sources of our rapidly increasing supply are no index whatever to the future because it is an industry in transition, and the countries at present supplying it are liable to severe readjustments of rank. It is now the product of a hunter, not of a producer in the industrial sense. In practically all rubber countries from Ecuador to Para and Assam, the native gatherer goes into

the great unclaimed forests; and, finding a rubber tree which may yield a few pounds of rubber each year if properly cared for, or a good many more pounds this year if bled as much as possible, he reasons that it would be foolish to leave the tree for someone else; so he kills it for the immediate supply. The more rapidly the killing goes on, the greater is the yield until the trees approach extermination.

In some parts of Central America the castilloa plant has been almost exterminated. The same thing is happening where the Africans are seeking the rubber trees for their newly discovered value, and the fact that rubber is the chief export of the Congo is a record not of an industry, but of the destruction of their rubber resources. The Amazon Valley output holds out so well because the rubber hunters are going ever farther up stream into Peru and Bolivia. It is true that other trees will grow again in the future if the seed trees are not all destroyed, but the process is slow and not the proper basis for an increasing industry.

Rubber Cultivation.—The greatest change in rubber supply is likely to come through the shifting of production from the isolate dying tree, to which the rubber hunter has laboriously cut his path, to the great scientifically managed rubber plantations in which tens and even hundreds of thousands of rubber trees will yield an annual crop. Since the opening of this century when the automobile made high-priced rubber and a famine threatened, there has been tremendous interest in rubber cultivation throughout the world. In the spring of 1910 the high price of rubber helped to cause an excitement over rubber shares in London that rivalled the classic South Sea Bubble, both in the high prices of stock and the following collapse. Wherever soil, climate, and labor conditions are most promising, rubber growing is being, or is soon likely to be, tried. The variety of soils is considerable and the possible rubber region is very large indeed, including the equatorial rain belt which encircles the world; while the cera rubber tree has demonstrated its ability to thrive on dry, stony tropic uplands, and the guayule bush of north Mexico, in the latitude of Texas and a climate of frost, grows and produces rubber in lands too arid for a forest or even the tilled or pastured field.

Many products have passed through this transition from a free product of nature to a cultivated plant, and rubber cultivation has succeeded in the equatorial rain belt. There is now prospect of very keen world competition in rubber, a competition which is made easier by the simplicity of the business. Coffee and rice growing require rather expensive cleaning machinery, but rubber requires only a few trees, a knife, and a tub, for the practice of simple methods of gathering and coagulating the juice. Already there are large plantations of the castilloa rubber tree operated by American capitalists in the lowlands of Mexico, Nicaragua, and other Central American countries. In Hawaii one company has 40,000 trees large enough to tap at the beginning of 1913.

The English and the Germans, ever desirous of making their Old World colonies productive, are cultivating the Kicksia rubber tree in their west African and East Indian colonies in the rubber zones. There are rubber plantations in Borneo, in India near Madras and in Mozambique.

The Japanese are planning to cultivate rubber in Formosa, the French in Indo China, and the British Government has plantations of Assam rubber in the northeastern provinces of India. But it is from the East Indian Islands and the Malay Peninsula that we may expect the greatest developments of rubber cultivation. Over this whole region the Para rubber (hevea) tree thrives exceedingly well, there is abundant labor supply and skilled European supervision.

The hevea was first successfully cultivated in Ceylon. The most careful and scientific methods are there being applied to it, with the result that the export of cultivated Ceylon rubber already bears a better reputation and brings a higher price than that from Para itself. It has been found that a tree ten years old can be depended upon to produce annually from 1 to 3 pounds; 25 pounds have been taken from a single tree without injuring it; the tapping of the trees does not hurt the yield, which has actually increased with the age of the trees. It is the present practice to plant 100 trees to the acre. Ceylon, in addition to its moist climate and heavy rainfall, has a dense population, and, moreover, is able to draw tens of thousands of laborers across the straits from India. Rubber is being planted out in

some tea plantations so that the rubber trees will convert the declining tea plantation into a rubber orchard without cessation of income.

The Malay Peninsula is quite as good as Ceylon. It has a rainfall of from 100 to 200 inches, and the almost daily shower of the monsoon season in combination with the steady heat and humidity of the equatorial latitude sometimes produces, in three years a Hevea tree 60 feet in height. These orchards can be grown with side crops of banana, corn, or even cacao. Rubber land exists in indefinite quantity in these eastern archipelagoes with their thousands of islands, and hundreds of thousands of square miles over which the black-green forest comes to the very water's edge, and several varieties of rubber will grow.

The labor supply of Malaya is unique. The straits settlements (British) are a few settlements along the Straits of Malacca comprising a small fraction of the land area of the Peninsula. Here the British Government has kept the ferocious natives in order, so that the Chinese, industrious, quick to seize opportunities, have gone there for the business opportunities in a climate which they can stand better than Europeans. In 1911 the population (total 714,000) consisted of 7,200 Americans and Europeans, 8,000 Eurasians, 370,000 Chinese, 82,000 natives of India, 40,000 Malays, and 200,000 other Asiatics. In the native states under British control are 400,000 more Chinese. These Chinese laborers are doing the work on the rubber plantations. This makes Singapore, the metropolis of the Straits, the natural rubber metropolis in the cultivation era which is coming. Within a comparatively short distance of Singapore are the enormous labor supplies that can upon demand be furnished by the millions of China, of Java, and of India. The fare from China to Singapore was for years $2.50 per workman. These coolies are good workers and are at present content with twelve to twenty cents American gold per day, with the worker boarding himself. This kind of labor supply tropic America does not possess, and the feverish efforts of Brazil to enter upon the cultivation of rubber seem destined to poor success unless she imports Chinese laborers into her empty Amazon lands. At present the Brazilian states of Para and Amazonas are offering free land in blocks of 50,000 acres and various other subsidies

to responsible companies, who will undertake rubber cultivation. In the meantime, the unsubsidized cultivation of rubber on the Malay Peninsula and adjacent lands has already assumed large proportions. At Malacca, in the Straits of Malacca, a single Chinaman in 1906 owned an orchard of 300,000 Para trees. A few dozen such plantations would supply all the rubber required in the United States.

PLANTATION RUBBER OFFERED FOR AUCTION IN LONDON MARKET

(From report on 1911 by Gow, Wilson, and Stanton, of London)

Year	Ceylon	Malaya	Total	Average price
	Tons	Tons	Tons	Per lb.
1906	98¼	250¼	348½	$1.34
1907	192½	621½	814	1.17
1908	290	1005½	1295½	1.00
1909	432	2252	2084	1.59
1910	761¼	4432¼	5193½	1.86
1911	1622	8077	9099	1.23

While the above changes were occurring, the output of Para rubber declined a little. The rapidly increasing output of plantation rubber is suggestive of the shift in supply and most of the orchards have not yet come into bearing. In 1911 100,000 acres in Malaya averaged 200 pounds of rubber per acre. The 85,000 acres of Hevea in Java sent only sample shipments and it is reported that half a million acres were planted in the Far East in 1911. Sixty-seven leading companies in Malaya in 1911 averaged 1997 1/2 acres of rubber each at a capital cost of $190 per acre each. One of the oldest companies has shares with par value of two shillings and selling at forty-two (Jan., 1912).

One of the most suggestive of factors in the rubber situation is the receipt in London during 1911 and early 1912 of regular shipments from east Africa of the Manihot rubber, the product of the Ceara, or arid land tree of the Brazilian uplands. This grows in a climate that is much superior to that of the humid Malayan jungle. We may, therefore, expect to see an entire re-adjustment in the source of rubber supply and probably great

reduction in price consequent upon such systematic, scientific production with cheap labor and European management.

The industry will doubtless have its troubles. Being a new industry, there is much to learn and many companies have already failed from using wrong locations, wrong varieties and from mismanagement. Many of the plantings due to the great boom of 1910, during which year rubber fluctuated from $1.25 to $3.12 per pound, will be overgrown by the bushes in which the trees are planted. While the method of cultivation is simple, often merely chopping down other growth as it starts up, this dead vegetation is good material for a fire and even in Malaya there comes a dry season during which fires have run through and destroyed plantations. Then it is the usual experience that the domestication and crowding of any plant tends to develop diseases.

Laboratory Rubber.—It is quite possible that a decade hence we may find the rubber plantations sore pressed by the product of the chemical engineer turning out cheap, synthetic rubber in European, American, and Japanese factories. A process has been discovered (U. S. Con. Rep., July 11, 1912) whereby vegetable starch, costing two cents per pound, is converted by fermentation into fusel oil, this by chemical processes into isoprene, this by treatment with mineral sodium into rubber, "comparable in every respect to the natural rubber," according to laboratory tests. It has not been made in industrial quantities. It remains for the chemical engineers to perfect the processes of manufacture, but it is claimed that there is a probability of making rubber at sixty cents per pound and possibly at twenty-four cents per pound. Few things seem more certain than that, between the output of orchards and factories, our rubber-using industries are upon the eve of a new era in raw materials.

4. Rubber Manufactures.—The prospective cheaper and larger supply of raw materials will be fortunate for the United States. Already our rapidly growing rubber industries take nearly a pound of rubber per capita for all the people in this country. The enormous increase in the automobile industry promises to demand much more. The rubber boot and shoe, the best known of our rubber products, are produced almost entirely in the factories of southern New England. Unlike

ιther shoes, rubber shoes do not permit of manufacture by a ιgle worker. They require much machinery and have always en a factory product. The factories of Massachusetts, nnecticut, and Rhode Island make nearly nine-tenths of the tire American output of rubber boots and shoes, but the dustrial uses exceed foot wear in the quantity of rubber used in e United States. Rubber tires are everywhere manifest. ıbber hose is a universal necessity, filling a thousand uses; e air-brake system of every train requires it. Rubber packing engines, pumps, and valves, and rubber electrical supplies, ow how universal is the distribution of manufactured products rubber which thus go wherever steam goes and water is lifted. ır these purposes the products of American rubber factories e sent to every country in the world. Our well-nigh universal e of rubber shoes and cloth, and our extensive mechanical use rubber make this country the largest rubber user and the gest rubber manufacturer in the world. The countries next importance are Great Britain and Germany, but our rubber nsumption exceeds that of any two countries. Our exports rubber manufactures amount to over $8,000,000, going chiefly United Kingdom (three-tenths), Canada (one-sixth), France ne-ninth).

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CHAPTER XIV

THE MACHINERY, SHIP-BUILDING, AND METAL INDUSTRIES

1. FACTORS OF LOCATION

Ship-building must be done where the ships can be launched, but the location of other classes of machine building is influenced by two factors which often tend to conflict but which sometimes coincide—labor and the market. Machinery of all kinds is made primarily of metal, mostly iron and steel, and secondarily, of wood. It is easy to see how a carload of iron, steel, or wood is much less bulky than the same materials made up into machinery. It is therefore a transportation advantage to have the factories located near to the market rather than near to the raw material. On the labor side it is true that the distant market is often in a region of small purchases and high wages so that there is an advantage in labor cost if the machinery is made where the labor supply is abundant, the wages low, and a large product can be marketed. In some classes of machinery, such as agricultural machinery, the transportation cost is heavy in proportion to the weight, and the dominating influence of the market is strong, tending to locate the industry. In other classes of machinery such as clocks and watches the freight element in the cost to the ultimate consumer is relatively small and the labor element is large, with the result that the labor element has strong influence in the location of the industry. Another important difference to be observed among the different classes of machinery is the narrowness or wideness of the area of consumption. In this respect equipment machinery of the class used in textile or sugar factories is much more restricted than clocks, firearms, or vehicles which are for general consumption rather than for equipment of restricted industries.

MACHINERY EXPORTS OF LEADING COUNTRIES

Commercial America (Phila. Commercial Museums)

Countries	1890, millions	1910, millions
Great Britain	$80	$142
Germany	15	119
United States	15	110
France	9	20
Belgium	8	12
Switzerland	4	14
Netherlands	3	6
All other	5	43
Total	$140,000,000	$468,000,000

EXPORTS OF MACHINERY FROM LEADING COUNTRIES

Articles	1910, Great Britain	1911, United States	1910, Germany
Prime movers of all kinds, steam and traction, including locomotives.	$ 8,000,000[1]	$ 16,046,000	$ 29,500,000
Machine tools	3,475,000	....	....
Metal working machinery	....	9,625,000	14,200,000
Wood working machinery	....	1,827,000	3,000,000
Textile machinery	37,050,000	....	12,300,000
Sewing machines, and parts of typewriters	8,400,000	{ 9,039,000 9,800,000 }	10,200,000
Agricultural machinery	13,071,000[1]	24,670,000	5,200,000
Parts of agricultural machinery, and other agricultural implements.	....	11,400,000	....
Printing presses and machinery.	....	2,854,000	4,000,000
Mining machinery	6,230,000	7,010,000	....
Electrical machinery	8,000,000	8,025,000	....
Sugar machinery	....	....	2,300,000
Shoe machinery	....	1,633,000	1,500,000
All other	58,224,000	27,271,000	33,000,000
Total	$142,500,000	$129,200,000	$119,000,000

[1] Including traction engines.

The manufacture of machinery is nearly always a sort of second stage in industry, the first stage being the prosecution of the industry, using the machinery, and developing the market for it. The order of development is somewhat as follows, as shown, for example, by Russia—first agriculture, then after importing agricultural machinery for a time its manufacture begins, but in factories equipped with machinery from countries more advanced in manufacture. The manufacturing of machinery to make machinery is a yet more mature stage of industry.

With world commerce the use of machinery is spreading into the remote corners of the world, hence a rapidly increasing export from the manufacturing countries.

2. THE MANUFACTURE OF AGRICULTURAL MACHINERY

The Origin of Agricultural Machinery.—Large areas of cheap land in combination with the consequent high wages have dominated industrial conditions in the United States and made it impossible for the farmers, under the old system of hand labor and simple devices, to cultivate as much ground as they could easily secure. Necessity has in this form been the mother of the invention of agricultural machinery, which has been perfected to a greater degree in this country than in Europe. The decades beginning with 1840 and 1850 saw the settlement of the American prairie, a natural home of the farm machine, going on in good earnest: and it was in 1851 that the first reaper was made. After this beginning the new machinery came rapidly. These inventions and the great demand for the machinery have given rise to an important manufacturing industry, and the excellence of the product has led to a large and growing export to the agricultural countries of the world. The thoroughness of our invention and the scope of our agricultural machine works is shown by the virtual absence of imports of machinery of this class, while we have exports far greater than any other country.

The Service Rendered by Agricultural Machinery.—In 1850 we produced 1 ton of cereals per person. In 1900 with a smaller proportion of the population engaged in agriculture, we produced 1 1/2 tons of cereals per person. This increase in the efficiency of the producer of breadstuffs is due largely to the ma-

chinery he has used. The inventors and manufacturers of agricultural machines have produced many devices to do each important agricultural process. Thus agricultural machinery has replaced hand labor in production as the locomotive has replaced the wagon in transportation, and the two classes of machinery together have given the world cheaper food and raw materials than it ever had before.

It would be a great error to think that this process of machine improving has ended or that its results are all in sight. The census of 1910 showed astonishing changes due to agricultural machinery. Within 10 years[1] the rural population of Ohio,

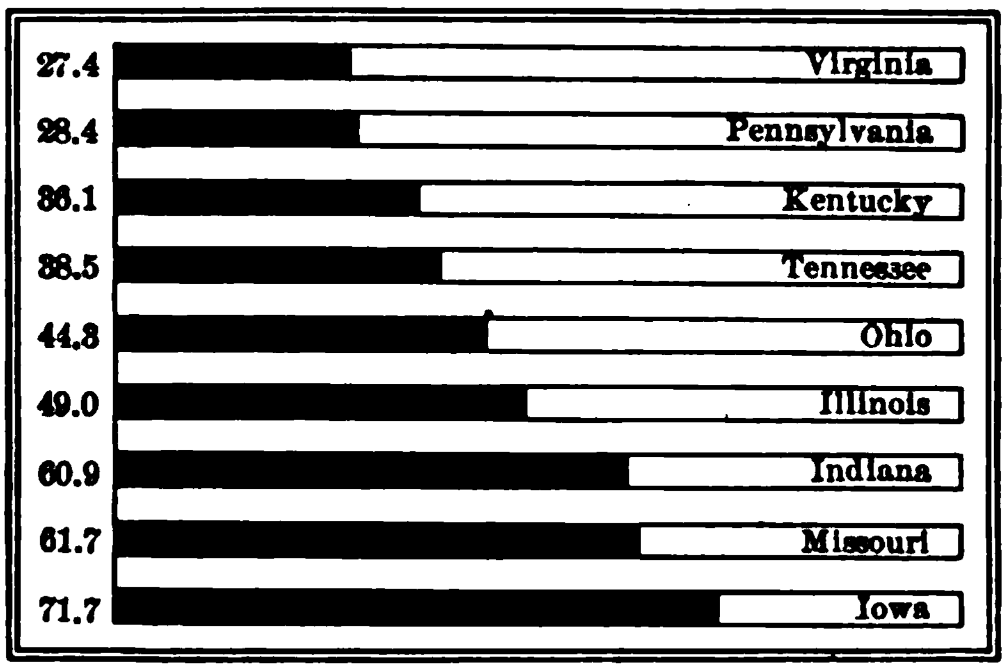

Fig. 184.—Percentage of counties losing population in nine great agricultural states 1900–10. Iowa probably leads all states in its exclusive dependence upon one of the most modern types of American agriculture.

Indiana, Illinois, and Iowa declined 6 per cent. This means an increased use of machinery which increased 50 per cent. in value. It was accompanied by an increase of 5 acres in the size of the average farm, an increase in the number of horses and a decrease in the number of people per farm. Agricultural machinery removes man from the land, as shown by a population of seventy-one persons per 1,000 acres on the best level Ohio land and seventy-four per 1,000 acres on the poorer hilly southwestern Ohio. In Illinois the corresponding figures were thirty-eight and forty-five per square mile.

Manufactured Near the Market.—Agricultural machinery is very bulky; freight rates are therefore high, giving a great

[1] B. H. Hibbard, paper before the American Economic Association, 1911 Meeting, Washington.

advantage to the factory located as near as possible to the place where it will be used. Therefore, this industry has always kept close to the edge of the great farming region, especially the grain belt. For a time the leading manufacture was in central New York where the Erie Canal gave easy transportation to both east and west. Even yet the industry is the leading industry in the city of Auburn, New York, but the center of the industry has moved west with the westward movement of agriculture. The first centers beyond the Alleghenies were Columbus and Springfield, Ohio, on the edge of the vast level plain of the corn belt, which has been the compelling force to make men use farm machinery. With the further westward movement of the market, the industry centered in Chicago, the greatest agricultural market in the world, the greatest railway center in the world, in the hearts of the corn belt, the hay belt, and of the oat belt, and also near to the wheat regions. Here are the best facilities in the United States for reaching agricultural districts, and here the Harvester Trust located its plants. These influences have made Chicago's manufacture of agricultural implements five times greater than that of any other city in the country, although in 1880 it was but half as great as that of Springfield, Ohio. All the other centers of importance are located in states near or bordering on the Great Lakes. Lake shore localities have as favorable conditions for the assembling of raw materials as are to be found anywhere. On or near the shores of these lakes are abundant supplies of wood and iron, the chief raw materials used. Some firms have developed so far as to own forests and saw mills in Missouri and Arkansas, iron mines on Lake Superior, and blast furnaces at Chicago for the manufacture of iron and steel. Important centers in a position to share Chicago's advantages are South Bend, Indiana, and Racine, and Milwaukee, Wisconsin.

The westward trend of the industry is shown by the fact that Springfield, Ohio, once the second city in importance, has been recently surpassed by Moline, Illinois—a town on the banks of the Mississippi River distinctly to the west of the important manufacturing part of the United States, a fact reflected in its present great dependence on the manufacture of agricultural implements. Peoria, Illinois, and Richmond, Indiana, are

other important centers. Thus far the export trade has not led to the manufacture of this machinery in seaports convenient to the place of shipment, nor is there any apparent prospect. The export is a by-product of the home industry which amounted in 1910 to nearly $150,000,000.

Interchangeable Parts.—The manufacturing of agricultural implements has received a great impetus from the practice of making machines with interchangeable parts, so that one machine in the factory turns out one piece which will fit any one of thousands of a given kind of completed machine in the field. Before this practice was established, a breakdown in the field meant that the machine had to be taken to some nearby expert mechanic to be repaired. With interchangeable parts, the owner of the broken machine can get quick repairs, by ordering a new piece by catalogue number from some nearby warehouse—an ability which has made possible the easy use and prompt repair of Chicago reapers and Moline plows in the wheat fields of Argentina or Russia, thus greatly stimulating our foreign trade.

The interchangeable part, by emancipating the user from the limitations that follow distance from the factory, has enabled the American manufacturer to reap the advantage of the adjustment of his product to the environment. American agricultural machinery has, as the result of numerous inventions and specializations, been made to fit the great variety of conditions existing in the United States, and for this reason it also suits any other country. Each kind of land and of farming has had machinery adjusted to it, thus we send machines of the so-called "stump jump" types to the newly cleared Australian "Bush." In contrast to American adjustment to special needs, the English have long prided themselves on the substantial character of their manufacture. The American agricultural machinery is much of it lighter in weight, less durable, but less expensive, and for these reasons it appeals strongly to the frontier bonanza grain farmer with his limited capital, whether he be on the plains of the United States, Canada (taking 13 per cent of this export), Argentina (21 per cent), Russia (18 per cent), or Australia, in all of which countries our machinery is much used. This combination of patents, adaptation, and prices gives us one of

the few branches of manufactures in which America has outstripped foreign countries with cheaper labor and approximate equality of raw materials. We are even exporting over a million dollars' worth of agricultural machinery per year to the United Kingdom, long our chief rival, while France and Germany together take over one-eighth of our total shipments.

2. CARRIAGES, WAGONS AND AUTOMOBILES

Relationship to the Agricultural Implement Industry.—The wagon and carriage industry of the United States, which more than supplies the home market, is greater than that of any other country in the world. Our home market is larger than that of any other nation, our scattered agricultural population has to haul its product over the worst roads possessed by any wagon-using country with the possible exception of Russia. The badness of the roads wears out the vehicles, which the factories must supply. The carriage and wagon output exceeds the agricultural implement output, and the two industries have a kind of economic kinship. Wood and iron are the raw materials in both; both are relatively bulky when completed, and, therefore, need to be made near the market, which is located primarily in the same region. Every farmer must have one or more wagons, but the inhabitants of a manufacturing town use them to a relatively small extent in their business. Every farmer needs a carriage, but the trolley, the omnibus, and the train serve the city dweller. The chief market, therefore, for these vehicles is in the same region as that for agricultural implements, making evident the fitness of the North Central States for leadership in both industries.

The Raw Material—The deciduous trees furnish nearly all our carriage material. Second growth hickory, which was picked out by Peary to make the sledges for his dash over the Arctic ice fields toward the north pole, is one of the monopolies of the United States. This wood, unrivalled for strength combined with elasticity, grows from New York to Georgia and Missouri, and is almost universally used for making the strongest parts of light carriage wheels. Heavy wagon wheels are made of oak, the beds are made of the light poplar or tulip wood, and the

light and strong ash is used for the framework and tongues. All of these woods are widely distributed in the region adjacent to the North Central States, being found in greatest amounts in the Appalachian District, Kentucky, Tennessee, Missouri, and Arkansas. Chattanooga and Memphis are the greatest hardwood markets in the country. Ohio and Indiana have for several decades been exporters of the best oak wood, although their supply is now nearly exhausted. Michigan and Wisconsin, which predominantly produce pine, also have considerable quantities of carriage woods.

Westward Movement of Carriage Industry.—The carriage industry, like the manufacture of agricultural implements, has moved westward with the centers of agriculture and population. It has actually declined in New England; remains nearly stationary in New York and Pennsylvania; and has greatly increased in the West where six states—Ohio, Indiana, Illinois, Michigan, Wisconsin, and Missouri—manufacture more than one-half of the total product of the country. The industry is still moving toward the raw materials, the greatest rates of increase being found in North Carolina, Kentucky, Missouri, and Georgia, *i.e.*, in those states which are nearest to the predominant raw material, wood. Cincinnati is the leading wagon and carriage manufacturing city in the United States; St. Louis, near to the Ozark lumber and the prosperous southwest is second; while South Bend, Indiana, a part of the Chicago manufacturing district, is third. Of the seventeen cities having over a million dollars of output in 1904, only three, New York, Philadelphia, and Watertown, N. Y., were east of the Allegheny Mountains. Four of these cities were in the lower peninsula of Michigan; two, Louisville and Owensboro, were in Kentucky; three were in Indiana, and two, Chicago and Moline, in Illinois.

Concentration and Revolution of Carriage and Wagon Making.—The manufacture of carriages and wagons has gone through the process of concentration similar to that which has occurred in the shoe and textile industries. Two generations ago the country blacksmith and wheelwright had their shops side by side. One did the wood work and the other the iron work, and they manufactured wagons for their neighbors as the shoe-maker next door made the shoes. As shoe machinery has replaced the

shoe-maker, so automatic wood working machinery has displaced the country wagon-makers whose hand-made output can no longer compete with the cheaper product of the factories in the North Central States, which send their output to every state and county in the Union, and, in limited amounts, to foreign countries. Our chief exports go to the Argentine Republic (26 per cent), Canada (25 per cent), Mexico, Great Britain, and her colonies Australasia (12 per cent), and South Africa. These are countries whose physical conditions resemble our own and our vehicles are suited to them.

The Automobile Industry.—The automobile affords the newest of the important industries in the United States. The first modern automobiles were made in France in 1891. By 1900 they had proved their efficiency and the new industry was established in America, increasing since that time with astonishing rapidity. The American output for 1910 is estimated at 160,000 machines each worth $2,000, and the total product exceeds in value all the other vehicles and agricultural implements combined. The automobile is akin to the carriage in its uses, and in the materials and processes of its manufacture. It differs, however, in being much more predominantly of iron and in being much more complex. Its parts are numerous, they must be of exact material and proportions, and are therefore difficult to make. Each factory turns out but a limited number of machines in a year, consequently it is inexpedient for each plant to make all its parts. For example, such an item as the ball bearings require for their manufacture a large and expensive plant, one in Philadephia, extending for two city blocks, is capable of making enough ball bearings for dozens of automobile works. Similar expensive plants and careful processes are necessary in making many other automobile parts, so that the industry is, to a considerable extent, an assembling industry—that is, many of the parts, sometimes fifty or one hundred or more are bought and combined with others made at the factory to form the completed machine. It was very natural for the carriage makers of the agricultural Middle West to take up the manufacture of this new kind of carriage. It is apparent that they are dependent not so much upon the lumber of Tennessee as they are upon the machine shops of New England, New York, and the

North Central States. Therefore, this species of vehicle-making clings to the northern edge of the region that has long manufactured our carriages and wagons. Detroit and Cleveland, together producing over a third of the entire output of the United States, are the leading centers. The three other cities next in importance—New York, Buffalo, and Indianapolis—are also located on main lines of railroad between New York and Boston and Chicago. There is some automobile manufacturing in Connecticut, Massachusetts, and eastern Pennsylvania, and some in and around Chicago. Owing to the infancy of the industry, rapid changes, such as that which caused Michigan and Ohio to rapidly outstrip Connecticut in the few years immediately following 1900, may be expected. The great dependence of the automobile factory upon other factories gives a strong tendency for these industries to cluster round one great center. This seems to be occurring at Detroit, which is now far ahead of all other cities, and the rapid increase in the allied industries in and about the city tends to make it the most favorable place in the country for a new factory to locate. Some automobile works are even moving there.

Foreign Trade in Automobiles.—The automobile was first made in France, but the Americanization of the industry has been complete. This is shown by the fact that, as a result of our rapidly increasing industry, our imports, at first largely from France, have decreased and our exports increased until our export of 12 million in 1911 is greater than that of all other countries in the world combined. Canada (38 per cent, 1911) and the United Kingdom (17 per cent, 1911) are the largest importers of American machines, with Australasia next in importance.

This dominance of America in export is scarcely likely to continue. The export of other countries, especially Germany, is increasing rapidly and our export appears to be due largely to the factors that have operated in the export of agricultural implements—cheap construction through interchangeable parts and the adaptation through rapid invention of our automobiles to hill climbing and bad roads, both of which are important factors for American automobiles.

The automobile industry has sprung into importance so suddenly because it combined a number of factors. It began as

the most widely prized pleasure vehicle and so continues. The high price of horses and the rapidly rising price of grain have combined with technical improvement to make it the most economical kind of vehicle for many kinds of hauling along the common highway where roads are good. This is especially true where the distances to be covered are considerable and the replacement of the horse-drawn vehicle is in rapid progress in both Europe and America. In Jamaica the motor truck carries bananas from the plantation, as in the north temperate zone it carries farm products to the market, and merchandise to the house of the consumer. These industrial factors will probably preserve the automobile from any slump so surprising as that which overtook the bicycle industry. This machine, owing to its popularity, was exceedingly important between 1893 and 1900, and gave rise to an important industry in Connecticut, Massachusetts, New York, and Ohio. The spread of the trolley lines hurt its usefulness, the automobile helped to put it out of style, and the decline of this industry was as sudden as its rise, the output of $22,000,000 in 1899 having been reduced to $3,000,000 in 1905, and $2,500,000 in 1909. At this latter date the motorcycle output was of greater value ($3,000,000) than the bicycle. Fifteen hundred motorcycles are in use in Johannesburg and among the scattered mines of the Rand—an evidence of the usefulness of this new type of vehicle.

European Automobile Industry.—The European automobile industry resembles that of America in its rapid growth, but the speed of its increase has been somewhat less than that in the United States because the proportion of the European population who can afford autos is not so great as that in America. The fact that European roads are much better than those in America has caused the evolution of somewhat different types of machines.

4. MACHINERY FOR MANUFACTURING

The manufacture of machinery for manufacturing tends to occur near to the place where used. Aside from the advantages of freights and transportation there is a great convenience resulting from the increased ease of running back and forth

that specifications are carried out and repairs promptly ɔd.

iles, our oldest modern industry, give ample illustration of ıctors in the location of their machine supply industry. lk of the English textile machinery is made in Manchester, Oldham, Accrington, and Rochdale, all of them in the hire district. As this district has led the world in making o it has led the world in the export of textile machinery, h Britain far exceeds all other countries together. The ıtion of British exports of textile machinery is almost a of the geographic distribution of the textile industry.

Ր OF TEXTILE MACHINERY FROM GREAT BRITAIN (1910) TO SPECIFIED COUNTRIES

Country	Amount
	Millions
....	$5.9
States..............................	5.5
....	4.2
y....................................	4.0
....	2.3
....	1.7
....	1.7
....	1.1
....	0.7
....	0.7
....	0.6
....	0.6
....	0.5

ɔuld be noted, however, that this table is not a record of of the industry in the importing countries, for leading naking countries are making this class of machinery, British export is not increasing.

ermany its manufacture and export are important in the Valley textile districts of Alsace and Baden, and in the States similar facts appear.

Worcester, Massachusetts, near the center of the New England textile field, is the leading American city for the manufacture of textile machinery. Other cities of southern New England, especially Massachusetts and Rhode Island, share in this manufacture, and as the textile industry is growing in Philadelphia, so also is the manufacture of textile machinery springing up there.

Importance of Machine Tools.—The machine tool is the keystone of machinery manufacture. It is a recent invention for the easy shaping of the wood and iron parts of the machinery upon which manufacturing depends. The fashioning of wood and metal can be reduced to a few simple mechanical operations—planing, boring, turning, milling, and slotting, which have for ages been done by hand or by very simple mechanical aids. For each of these operations large, heavy, expensive, but exceedingly efficient machines have been devised. Planing machines will, when once set and started, work for hours smoothing one side of a piece of metal as big as the floor of one or two small rooms. Boring machines will make holes as desired, milling machines will cut notches upon the outside of pieces of wood or iron, and by this process will take a smooth, round disc of metal, and, with no attention whatever from the operator, grind away for hours leaving it a completed cog wheel. Lathes make pieces of wood or metal almost any shape that a pattern may prescribe, even when the pieces are as thick as a man is high and as long as a telegraph pole. The irregular shaped handles of axes and hatchets are good examples of lathe work, and even the last for a shoe is a product of the turning lathe. The fifth of these fundamental machines is the slotter which cuts any kind of grooves in metal or wood, and like the other four works by mechanical power and needs little attention from the operator. These mechanical units have been combined into a class of machines called turret lathes which perform a number of different operations by having tools arranged on a rotating wheel, each of which automatically comes in turn to do its part of a finished whole. Thus a rod will be cut into a series of perfect bolts, nuts, or screws of exact dimensions. These mechanical means produce the many parts which, upon being put together, make the complex, efficient machines of the modern factory.

Many of these machine tools have been improved to the point

where they become automatic. This condition is attained when a machine will take pieces of material and turn out a uniform product. Thus a roll of wire is fed into one end of a machine and finished wire nails come out at the other; a roll of brass or steel wire is by these processes converted into a screw and each of the three processes is done by a machine that takes the blanks by the bushel and works them up.

The Manufacture of Machine Tools.—The machine shop is the market for machine tools, and the machine shop is located where machinery is to be repaired or made. It is plain that repair shops, even more than plants for new construction, must cling to the places where machinery is used. The machine-tool industry is therefore located by the machine users, and interesting responses of location result. It is an industry without any great center. In seeking its market it tends instead to scatter itself over the whole region of manufacture.

It started in New England, has moved west with the movement of manufactures, until Ohio now leads with a product one-third as great as all the rest of the country put together. Ohio leads in this industry because she is in the iron and steel district, which gives abundant raw materials, and, moreover, requires much machinery. Ohio is also central to the region for the making of agricultural implements, wagons, carriages and automobiles, and has excellent transportation to all manufacturing centers by lake steamer, river steamer, and the trunk-line railroads which thread the state in every direction. Cincinnati and Cleveland have therefore become the greatest machine-tool manufacturing cities in the United States, Hamilton and Dayton also being important points.

Philadelphia is another center for this line of manufacturing, because of the need of her textile mills, her engine factories, her locomotive works, and the shipyards of Camden, Chester, and Wilmington upon the Delaware. Chicago, the heart of a rapidly increasing manufacturing district, is also rising in importance in the manufacture of machine tools.

In New England, the mother of our manufactures, machine-tool making is important in Worcester, Massachusetts, and surrounding towns, for without them the manufacture of textile machinery, automobiles, fire arms, and other metal products,

could not well go on. Machine tools are also made largely in Providence, Rhode Island, and New Bedford, Massachusetts, both of which are textile centers, and in Hartford, Waterbury, and New Haven, Connecticut, close to the varied manufactures of southern New England.

Engines and Motors.—Engines or electric motors are used in almost all kinds of factories, and also in nearly all mines and on many farms. Their market is not quite so restricted as that for machine tools, but their manufacture is located by the same factors and is distributed in the United States from Lake Michigan to the Atlantic and southward to southern Pennsylvania. Some of the heaviest engines in the United States are made at Milwaukee, Wisconsin, which is conveniently located to distribute them by boat to all manufacturing cities on the Great

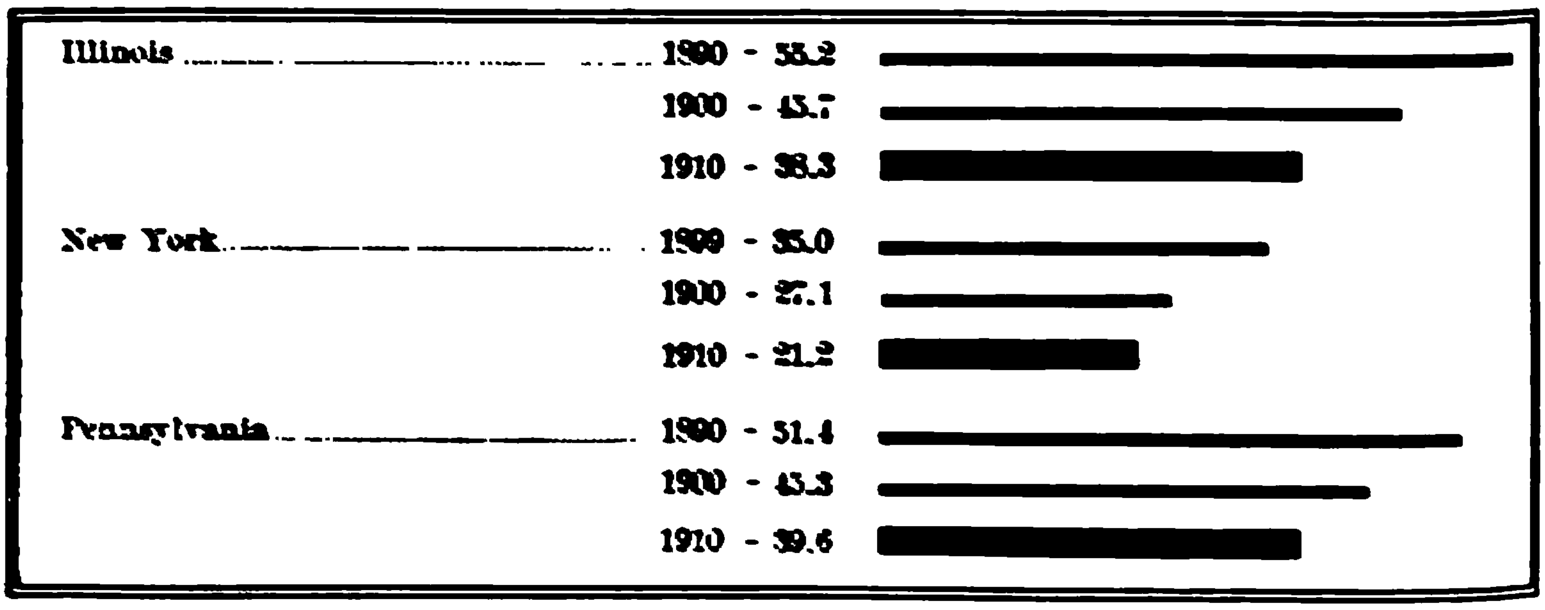

FIG. 183.—Urban population: per cent. of totals. The competition of western machine-made agricultural products has combined with the factory lure to cause an abnormal condition in the rural East.

Lakes and by rail to the North Central States and the mining regions of the Rocky Mountains. Further east, Pittsburg with its huge iron-manufacturing plants, requiring so much heavy machinery, is an important center for the manufacture of heavy engines and electrical machinery. Philadelphia, New York and environs, and southern New England have other important engine manufactures. At Schenectady, New York, on the main line of railway from Boston and New York to the West is one of the greatest electrical manufacturing plants in the world.

In the manufacture of engines, Germany is the leader on the scientific side. Science is respected more and taught more

iere than in any other country, and new types of engine are rimarily the result of a great amount of scientific study and xperiment. Another force driving to this result is the German carcity of good fuel, a fact which places a premium on economical ower generators. It is from Germany that we get our processes f utilization of the by-products of coal and coke, leading makes f gas engines, including the promising new Diesel engine. It s a natural result of Germany's science that she is exporting nore engines than the United States and the United Kingdom ombined.

5. MACHINERY FOR TRANSPORTATION

Railway Cars.—Transportation, which plays so vital a part in this country, employs an enormous number of people. The mere building and repairing of the 2 million freight cars employs as many laborers as does the woolen industry in Great Britain, and the number of workers, 300,000, far outranks the 175,000 in the American woolen industry. The annual value of this work is placed at over $400,000,000, an amount greater than the value of the product of the American blast furnaces in the same year. Although every railroad has repair shops scattered along its lines at junction points and at ends of divisions, this work is, so far as possible, concentrated in the best locations. Illinois, with Chicago, the greatest railroad center in the world, leads all the states in the Union in the manufacture and repair of cars. In addition to having a great many railroad repair shops upon the numerous lines which have their headquarters in Chicago, there is at Pullman, a suburb of that city, one of the largest car factories in the world, devoted almost exclusively to the manufacture of parlor and sleeping cars. The recent rapid change from wood to iron as the material for car making tends to locate car manufacturing in the iron belt, and the Pittsburg district of western Pennsylvania is now a great center for the manufacture of steel cars. There are also important manufactures of this product in western New York, southern Michigan, Indiana, and Missouri. St. Louis, the great railroad center for the southwest, is an excellent place for the manufacture of this class of railroad equipment and it also has one of the two

largest trolley-car manufacturing plants in the United States, its only rival in size being in Philadelphia. Owing to the violence of their use, the repairing of cars in the United States employs six times as many men as their construction, and the cost of new cars is less than one-third the cost of the repairs. With street-railway repairs the ratio of repairs to cost is over four to one, but the total of both repairs and cost is only one-thirteenth as great as for the steam cars. Manifestly the repairing of electric cars must be in the localities where they are used.

Locomotives.—In the manufacture of locomotives, Philadelphia leads every city in the world. One plant there makes about one-third of the output of the country, and, with the assistance of plants at Pittsburg and Scranton, gives to Pennsylvania one-half the entire output of the United States. Philadelphia's leadership is due to no one cause. It is an industry which, so far as the general situation is concerned, is almost equally at home anywhere between Chicago and New York. The Philadelphia plant has a unique labor organization, the city has excellent supplies of coal, is reasonably near the sources of iron, and, being a city of homes, has an abundant supply of workmen for the plants. The great locomotive works of Philadelphia have outgrown their city location and are gradually moving to a more roomy suburb on the banks of the Delaware. New York state produces one-fourth of the locomotives of the country, the most important center of manufacture in that state being in the city of Schenectady, which also produces so much electrical machinery. The ease with which a locomotive can run to its place of final delivery on the American railroads makes this branch of machinery manufacture less dependent upon market and more dependent upon labor than are most kinds of machine manufacture.

Few important industries approach locomotive manufacture in the extreme degree of fluctuation in prosperity. In periods of promising traffic and easy borrowing, the railroads order locomotives, and at other times they do not. The booming prosperity of 1906 resulted in the manufacture that year of 6,592 locomotives in the United States. After the panic of 1907 the output of 1908 fell to 2,342. The census of 1905 showed an output for 1904 of $59,000,000. In 1909 it was $31,000,000.

6. EUROPEAN MACHINE MANUFACTURE

The European manufacturing districts have in their midst machinery manufacture similar to that of the United States. he most important manufacturing region in this country, unded by a line connecting Chicago, Boston, Baltimore, and . Louis, thence back to Chicago, has its counterpart in Europe a line connecting Edinburg, Berlin, Vienna, Florence, Lyons, ublin, and thence back to Edinburg. This European manucturing district is older, its industries are in some respects ore advanced, more mature and more refined than those of merica. One of the most conspicuous differences between merican and European machine manufacture is the greater ement of labor value in much of the European output. This ises naturally from the cheaper labor of Europe. The high st of labor in America has driven us to the second difference, e greater degree of inventiveness which shows itself in the cellence of our automatic machines and the superior design many of our machine tools. It is manifestly design, rather an cheapness of material or skill of workers, that causes the eat Swiss firm of Sulzer, manufacturers of engines, pumps, d refrigerating machinery, to secure 40 per cent of its machine ols in the United States. The increasing excellence of German achines of this type is leading to the prediction that our leaderip through patents is temporary, and that we may lose some our machinery trade as we have lost much of our bicycle port. As further evidence of this increasing European simirity of industry is the opening of an Italian thrashing-machine ctory that has cut off the import of those machines. Most ggestive of all is the opening in various European countries branch plants by American companies. This has long been e case with sewing machines, and recently an American gricultural implement company opened a branch near Moscow employ 1,100 men and make mowers and reapers.

The European machine plants are usually smaller than those the United States. As the home market is usually the main pendence there as elsewhere, the possibilities of market have en much smaller than in America, and the rapid expansions common in America are not common in Europe. Thus the

leading Swedish locomotive works recently celebrated the completion of its one thousandth locomotive, and the leading American plant celebrated the completion of its thirty thousandth, and can make nine locomotives a day. It will be noted that there is a fairly close ratio between the output of the Swedish and American locomotive works and the locomotive needs of the two nations. Sweden is, as a matter of fact, like Switzerland and Germany, making rapid strides in the development of high-class machine manufacture. The Swedish specialty is dairy machinery—Sweden being a dairy country.

7. SHIP BUILDING

How Ships are Built.—The ship is the largest object that man can move, the most complex of all his devices, and the one with the most thoroughly correlated parts. The usual method of building a ship is to lay down its keel or back bone upon a series of inclined blocks called a "way," from which the ship is finally allowed to slide into the water when the hull is completed. As it lies in the water the masts and machinery are added and the finishing work is done. In some places the method of building is varied by laying down the keel in a large dry dock, from which the water is pumped but into which it is allowed to run to float the ship when it is finished. Sometimes for repair work, especially of war vessels, floating dry docks are constructed which can be taken from place to place and do repair work where needed. In 1904 and 1905 such a dry dock, with ability to lift clear of the water a ship weighing 20,000 tons, was built in the United States and successfully floated by strong sea tugs to Subig Bay, Philippine Islands, for the use of the American Navy. The method of ship construction shows the necessity of locating ship yards upon deep, quiet rivers with an abundance of available land along the shore. It is better that the ship-building river have fresh rather than salt water, because it is less injurious to the hull of the ship. All of the important ship-building localities are near to iron- and steel- and machine-manufacturing districts.

Influence of Different Ship-building Materials.—The American ship-building industry has had its ups and downs; due partly

the influence of the change in building materials. From) to 1850 the world's ships were wooden sailing vessels, for ch New England, with her pine forests, not far from the supplies of the Middle Atlantic States, had the best and ipest material in the world. All along her coast, especially Maine, many shipyards were turning out vessels that were er and cheaper than those built in Europe. About the dle of the nineteenth century it was discovered that iron

a. 186.—Steamer in dry dock at Fifty-fifth Street, Brooklyn, after collision Massachusetts coast. Steel construction preventing shivering of ship and e-tight compartments prevented filling and sinking.

s were better for most purposes than wooden ships, and their rapidly increased. Iron was later replaced by steel. In supply of the raw material for this new type of ship, England, h her leadership in the iron industry, was far ahead of the ted States, so that in 1900 or 1910 England was as much ad of the United States in cheaply building the standard m vessel, namely, the steamer, as America had been ahead England in 1840 in building the standard ocean vessel of ; time, the sailing ship.

he working of the same changes is seen in the United States. ive years, 1857–61, the output of the New England yards

was nearly twice that of the Middle Atlantic and Gulf coast, but the latter, adjacent to iron and steel supplies, had triple the New England output in five years, 1907–11. The most significant fact of all is that during that half century when industries were multiplying by ten- and twentyfold, the total amount of ship-building on those coasts had not increased and had remained at a figure that is about 10 per cent of the British output of 1911.

Britain's Efficient Methods of Ship-building.—England's leadership during the latter part of the nineteenth and early part of the twentieth century is due partly to cheaper raw material, partly to cheaper labor, partly to abundant capital and the desire to invest in ships, and partly to the economy which comes from the great size of the industry. In America and on the continent of Europe, vessels are commonly built one or two at a time, but in the large shipyards in the British ship-building centers upon the River Clyde in west Scotland, the Tyne in northeast England, and the Irish harbor of Belfast, a half-dozen or a dozen steamers all alike are built at one time. As each part is duplicated several times, the cost for each ship is less than when built singly.

The British ship-building industry is a good example of concentration. The single city of Newcastle on Tyne built over a third more shipping (412,000 tons) in 1911 than the whole United States (291,000 tons) in the same year. Within 30 miles of Newcastle and spread along the eastern edge of the northeastern coal field are Sunderland (286,000 tons, 1911) Middlesborough Hartlepool (135,000 tons). On the Clyde, Glasgow produced 334,000 tons, and Greenock 206,000 tons, putting the output of the Tyne far above that of the United States. At Belfast (180,000 tons, 1911) is one of the greatest plants in the world. As it belongs to a Trans-Atlantic company engaged in the passenger trade, it builds vessels of great size. In March, 1912, twenty-six ships were under construction there with a tonnage of 328,000 tons.

For some decades England has been the chief source of supply for the shipping countries carrying the world's ocean freight. Thus Norway, a land of sailors for fifteen centuries past, has had to turn to British yards for ships now that steel instead of

wegian pine is the prevalent material. In 1911 Norway t an amount of British shipping equal to more than 25 per ;. of the total output of American yards. The navies of ty foreign countries from Japan to Chili depend upon British ls for their vessels, and large amounts of partly used British ping are annually sold to foreign owners. England's ship-ding output is five times that of her nearest rival, Germany. leadership in ship-building may be better appreciated by aining the table of the world's mercantile marines of which has built all of her own (46 per cent of total), and a part iany other nations.

WORLD'S MERCHANT MARINE

(*Bureau Veritas*, 1910–11)

Country	Tonnage in thousands
sh	18,873 (46 per cent of total)
ıan	4,306
rican	3,249
ch	1,898
regian	2,004
nese	1,281
ın	1,350
h	1,046
ian	1,366
lish	989
rian	765
ish	790
sh	742
k	639
ian	296
ilian	270
ntinian	185
an	160
ish	310
ese	90
ıguese	113
Total for all countries	41,046

Ship Building on the Continent and in Japan.—The rise of the German iron industry, the German merchant marine, and the German navy, have caused the establishment of fine shipyards in the German ports, especially at Stettin, so that that empire is now nearly able to supply its own ships. In 1911 the German ship output was slightly larger than that of the United States, supplying nine-tenths of the German demand of that year. In France there are shipyards in Marseilles, Havre, and Bordeaux; in Italy, at Genoa, Naples, and Venice, but the Italian output does not exceed 5 per cent. of the British. Austria-Hungary builds a few ships in her two ports, Trieste and Fiume upon the Adriatic; Russia has great naval stations at Sebastopol, on the Baltic Sea, and at Cronstadt near St. Petersburg, but most of the commercial or merchant ships that carry the commerce of Russia, of Austria, of Spain, of Australia, of all South American countries and most of the foreign commerce of the United States are built at the English ship-building centers of Glasgow, Dumbarton, Sunderland, Newcastle and Dublin, and the German port of Stettin. The shipyards of all the world have to pay more for their raw material than it costs the British. A recent Russian commission decided that owing to the adversities of yards remote from coal and iron and with tariff on imported materials, the government ought to pay a bounty of $38 per ton on shipping built in Russia to put it on a parity with foreign competition. The Russian handicap, amounting to three-fourths of the British cost, serves to explain British dominance in ship building. Many foreign shipyards would not exist but for the favoring influence of governments providing for a naval necessity. Thus Japan, with no iron industry worthy of the name, is now building three battleships complete, 14-inch guns and all. The yards that build them can repair them in time of need.

Influence of American Navigation Laws upon Shipping and Ship Building.—In order to afford protection to American shipyards, all vessels that engage in the United States coasting trade and all vessels of the American navy, are required by law to be built in this country. These two classes give employment to our shipyards. Our navigation laws compel vessels flying the American flag to have American citizens for a certain pro-

portion of the crew and further require that the men shall have better food and quarters than are provided on the ships of other countries. As the tariff protection to the iron and steel industry gives us high-priced steel, the American ships cost more both to build and operate than do foreign ships, and they cannot compete on the open sea. Thus practically all our foreign commerce is carried in foreign-built vessels which also bear a foreign flag. Our ship-building industry, therefore, has little to do with the foreign trade, and our large coastwise commerce and our increasing navy do not keep it in an increasing condition. While the cost is high the excellence of our war vessels caused American yards to secure the contract early in 1910 to build two battleships for the Argentine Government at a cost of about $20,000,000.

The Shifting of American Ship Building.—Our ship building has had a revolution in material which has tended to shift the location of the industry. Of the ships built in 1880 those made of wood were three times as valuable as those made of iron, but in 1905 those made of iron were five times as valuable as those of wood. This revolution has changed the character of our shipyards and changed the relative fitness of different regions for ship building. While the building of a wooden ship is largely a matter of carpenters and workmen, the building of the iron ship requires a large amount of expensive machinery and equipment. This gives a tendency to increased size of shipyards. Thus between 1850 and 1905 there has been no increase in the number of our ship-building plants, while the product has increased four-fold and the invested capital twenty-one-fold. The modern shipyard is so costly and of such great extent that the building of one large yard at Newport News near the mouth of the Chesapeake Bay in Virginia practically gives that state leadership in the amount of capital invested in this industry. New England, with its many yards for building wooden ships, is not so well located to build iron ships as are cities in the Middle Atlantic States. Two New England ports, Bath, Maine, and Quincy, Mass., have the equipment to build the largest vessels, but the many yards at Brooklyn and other points upon the waters of New York harbor, make that the greatest single ship-building center in America. The Delaware, sometimes

called the American Clyde, with yards at Philadelphia, Camden, Chester, and Wilmington, is the most important ship-building river in America. There is a shipyard at Baltimore, but the most important yard upon the Chesapeake waters is at Newport News. The more southern yards have less interference by ice, storms, and cold weather, and are about the same distance as Philadelphia from the great source of steel supply at Pittsburg. The yards upon Chesapeake Bay have a slight disadvantage in comparison with those of the Delaware and Boston bays because they are not so near the machinery and engine-manufacturing centers of the Middle Atlantic states and southern New England. Nature has favored this industry in the United States. The Clyde is but a creek dug out at great cost, while the Delaware is a wide open estuary with room enough to build the shipping for all the world.

Other American Yards.—Shipping upon the American Great Lakes renders great commercial service, and the vessels, being so large that they cannot leave lake waters, are built upon the lake shores. This industry accounted for approximately half of American ship building in 1910. The most important centers are at Cleveland, Chicago, Detroit, and Buffalo, although there is some ship building at Lake Erie ports other than Cleveland and Buffalo.

Although the Pacific states produce practically no iron, the need of equipment for repair work and the building of battleships has caused the establishment of first-class, modern shipyards at San Francisco, Los Angeles, and Seattle, but the output of new shipping is limited almost entirely to war vessels.

In practically every river town, fishing port, and seaport, there are small yards for the building of row boats, launches, fishing vessels, canal barges, and other special vessels many of which are usually of wood. This material, of which nearly one-fourth of our vessels are built, still serves for vessels used in sea, lake, and river fisheries, and as pleasure craft.

Navy Yards.—The enlarged navy of the United States requires Government Navy yards equipped for the repair of war vessels. As these repairs are often extensive, some yards are now able to build, and have built, large vessels and should therefore be ranked among the important ship-building enterprises of the United

States. They are located at Brooklyn, N. Y., Charlestown (Boston), Mass., Norfolk, Va., Mare Island (Vallejo), Cal., Bremerton (Puget Sound), Washington, League Island (Philadelphia), Portsmouth, N. H. (Kittery, Maine), and Pensacola, Florida.

8. SMALL METAL MANUFACTURES

Relation to Good Labor Supply.—An inspection of a hardware store reveals a collection of hundreds and even thousands of articles, such as saws, axes, cutlery, fire arms and ammunition, plumber's, tinner's and carpenter's tools, and that very long list of articles known as builders' hardware, nearly all of which are made of metal. A jewelry store reveals a collection of still more valuable metal products in which, as in the hardware, the metal plays a relatively small part, and the labor a large part in the cost of production. This high labor and small material value means that these articles are likely to be produced where population is abundant, as in New England, not where it is scarce, as in Virginia, West Virginia, or Kentucky.

The Distribution of the Industry.—The manufacture of most of these small articles in the making of which machine tools and automatic machinery are very important, particularly in America, originated in England and in Germany. It soon started up in this country, in southern New England, and has gradually moved westward through New York and Pennsylvania into the North Central States. Thus, at Gary, Indiana, a suburb of Chicago, the United States Steel Corporation has recently built the most perfect steel plant in the world. In it ore is unloaded from steamer at one end of the enormous plant, spread out on the Lake Michigan sands, and from the other end are shipped many small articles that may be bought in a hardware store. In the meantime New England is holding a leading place by making more and more refined articles as regions farther west take up branches of the metal manufacture. She continues to be a great center for the manufacture of fire arms and ammunition, important industries of Springfield, Massachusetts, where rifles and revolvers are turned out by the tens of thousands and cartridges by the tens of millions. Two towns in Vermont make a large part of the fine scales that weigh goods all over the

United States and also in foreign countries. Philadelphia has one of the largest saw factories in the world. A large part of the jewelry made in the United States is produced within 30 miles of Providence. Rhode Island, being the most densely populated state, becomes a natural home for such an industry, in which labor is so dominant a factor when you consider that both the valuable raw material and the finished product can be transported so easily. Silverware has its center of manufacture in some of the towns of Connecticut, which state also leads in the manufacture of clocks and watches, especially the very cheap clocks and watches.

In this class of industries it is plain that America is at a disadvantage with Europe in the combined factors of labor and raw materials. We have made advantages by invention, in which we have thus far led the world. Most of the articles of this type are patented, such as firearms, and typewriters, of which one factory in central New York exports millions of dollars' worth per year and sends its product to all lands. Sometimes the patent control lies not in the design of the article but in the method of making. When it comes to plain unpatented, simple things, European labor decides it, as in the case of toys, of which the world's supply comes so largely from Austria and south Germany.

Standardization and Interchangeable Parts.—The New England clock business has been made possible by the American system of manufacture, in which standardization and interchangeable parts have replaced the old hand methods by which every clock was different. Switzerland was long famed as the best watch-making country in the world, Geneva and vicinity being the center. These watches were made by hand, each wheel carefully fitted to the next wheel, so that if one broke the new one had to be shaped by hand to fit its mates. By the American method of interchangeable parts, fifty watches can be taken to pieces, each piece put into its own bin, and the watches may then be satisfactorily reconstructed by chance selection of the necessary parts. Thus, Connecticut can make alarm clocks and cheap watches at fabulously low prices, because of new methods of manufacture, perfected largely through American inventions.

'hese mechanical methods of manufacture, in combination ı the patented devices owned by American firms, have enabled manufacturers of New England, New York, Pennsylvania, Ohio, to sell builders' hardware, rifles, bicycles, clocks, type-ers, and many other patented articles in many foreign coun-ı, despite the fact that England and Germany have cheaper erial and cheaper labor. Apparently this trade can only be t up by the continued improvement of the patterns and hods, for if an article, like a microscope for instance, falls into class where it is a plain matter of labor and skill, it is made re skilled labor is cheapest. Thus America has never thought stablishing a wood-carving business. It belongs in Europe he yet more difficult ivory carving belongs in India with its cheaper labor, and as silk belongs in China and Japan with the ıpest of all labor. Indication of this adjustment of industry opulation is shown by the complaints of German makers of ıp clocks that Japan is selling them in China at prices no opean manufacture can meet (U. S. Con. Rep., July 18, 1911).

ropean Jewelry Centers.—The centralization of jewelry ing in the United States around Providence is matched in land by the leadership of Birmingham, and in Germany by three towns of Pforzheim, Hanau, and Gmeund. Pforzheim ıme the residence of fleeing French Huguenot jewelers, and industry was well established 130 years ago, by 1907 there ı 1,078 factories, and 30,000 workers, a number nearly equal ll those of the United States. The town has special schools rain jewelry workers, many of whom work in their own es.

REFERENCES

See General References

CHAPTER XV

CHEMICAL RAW MATERIALS AND MANUFACTURES

Chemistry: The Laboratory and the Factory.—Chemistry, the science, and the chemical industries are of universal importance in manufacturing. The printer depends upon them for his ink, the railroad builder for his dynamite, the blacksmith and the tinner for materials to make their metals weld, the glass maker and iron manufacturer for chemicals for fluxing and reducing ores. The chemist produces the painter's colors, the dyes of the weaver, the tans of the tanner, the fertilizer for the tiller of the soil, the drugs and medicines for the apothecary and the physician, and raw materials and commodities without number. The processes of the chemical laboratory which supply these necessities are coming more and more to be performed in factories on a large scale, as the basis of a rapidly growing industry of an importance in manufacturing that is to be likened only to the use of power. Almost daily some new chemical is discovered—some new device is so perfected that another laboratory process may become an industrial process, with the result that the prices of many chemicals are rapidly declining and the output rapidly increasing.

German Leadership in Chemistry.—Germany leads the world in chemical industries, because her people are, upon the average, the most thoroughly educated and especially because her universities had developed the science of chemistry for decades before it was important in any other country. The trained chemist of the German university very early found employment in German chemical works, and thus gave Germany her easy leadership over all other countries. The German government has also encouraged this and other industries in many ways. Since 1880 many German chemists have sought employment in England and America, and many Americans, trained in Germany, have returned to this country, where the teaching of industrial chem-

try has become general and the chemical industries are rapidly n the increase.

One of the most typical chemical manufactures in its scienfic nature, its importance, and its relation to other industries, that of dye stuffs. These are manufactured almost entirely om coal tar, one of the by-products of the by-product coke ven. This tar is one of the greatest chemical mines known. In 06, on the fiftieth anniversary of the discovery of the coal tar yes, 700 distinct color dye stuffs were in existence, and the tal number of aniline dyes recognized by chemists was over ,000. From this same source other chemicals are prepared, cluding carbolic acid and many drugs. Synthetic indigo made om coal tar has so nearly replaced natural indigo that the xports of that staple from India decreased from 21 million ounds in 1896 to 2 million pounds in 1910, and the average rice had dropped from eighty-five to fifty-five cents per pound. he chemical industry arising from coal tar products has an output of $100,000,000 per year, but the share of it outside of Germany is relatively insignificant. There are a few plants in New ersey and in New England, but about 95 per cent of the industry German.

I. THE RAW MATERIALS

The chemical industry resembles the textile industry in having few raw materials of great importance, and a host of minor nes. Thus sulphuric acid, most important of the acids, soda sh, similarly important among the alkalies, nitrate of soda, the otash salts, ammonia, and coal tar are to chemicals what the major fibers are to textiles. In both chemicals and fibers the ur ends of the earth have their contributions. Seeds and extracts om the plants and trees, rare minerals, and even the sea water self are sources from which the chemist with his laboratory is ver fusing, distilling, and extracting new substances of use to mankind.

Sulphuric Acid.—Sulphuric acid is the most important manufactured material used in the making of chemicals; and, or this reason, it is sometimes spoken of as the chemical barometer. Some persons even go so far as to say that one can auge the civilization of a people by the amount of sulphuric

acid they use. It is used extensively in fertilizer factories and nearly all other chemical works. It is made by a comparatively easy process from sulphur and water, and costs but a fraction of a cent per pound.[1] It gives the chief use for the sulphur consumption which now amounts to 18 pounds per person per year in the United States. Some of the sulphur we produce at home, but we get it chiefly as sulphur ore from the Rio Tinto and the Tharsis mines near Huelva, Spain, which together sent us nearly a million tons in 1911. Small quantities also come from Italy, Portugal and from Pilly's Island, Newfoundland. Owing to the ease of manufacture, most of the sulphuric acid is made where used in the fertilizer and other chemical plants, the rapid increase in the amount produced in the north central states showing the development of the chemical industries in that part of the country.

Soda Ash.—Almost equally important with sulphuric acid as a chemical raw material is soda ash, or sodium bicarbonate, used in manufacturing of soap, glass, and many chemicals. It is chiefly made by the Solvay process, a Belgian invention that has done much to cheapen alkalies. The sodium in the soda ash is furnished by common salt, in the form of brine secured either from salt springs or by the easy method of pumping water down through the earth to the salt beds through one pipe and pumping it out by another after it has done the work of the miner by dissolving the salt hundreds of feet below. Coal, coke, and limestone are also used in the process of manufacture; and the plants are usually located where salt and limestone both exist. The chief works are at Syracuse, New York, Detroit, Michigan, and other points along the salt deposits of these two states. The increase of this chemical product of wide usefulness has caused a great decline in its import from Germany.

We are not compelled to depend upon factories for soda. It is merely because of its cheapness. Certain lakes in the western Nevada deserts are highly charged with soda to be had by evaporating the water; a similar lake at Megadi, East Africa, has dried up, leaving a crystalline bed of soda. These lakes with their hundreds of millions of tons of soda have remained un-

[1] As a by-product from the fumes of a copper smelter at Ducktown, Tenn., the cost of sulphuric acid is only $2.25 per ton.

utilized because it was cheaper to make it near the place of consumption.

The Manufacture of Explosives.—Explosives have long been the most spectacular of the chemists' products. Long used for destruction only, they have at last entered industry, and are performing rapidly increasing services, since dynamite has become cheap. Without dynamite and gunpowder the prosecution of the mining and quarrying industries, and the building of our railways, tunnels, subways, and canals would be impossible. Our per capita consumption of explosives amounts to over 5 pounds per year, and in 1910 we shipped over 10,000,000 pounds for use in the Panama Canal. This commerce in dynamite is so great that over 2,000 cars upon American railways are constantly engaged in carrying it. This, too, despite the fact that the plants are scattered over the country from end to end to minimize transportation of the dangerous product. This one factor of danger and consequent cost of transport is the dominating factor which scatters the centers of manufacture, as high freights scatter cement plants. The assembling of the raw materials is much easier than the handling of the finished explosives, but it is a distinct advantage to have the plants on tide water as the banks of the Delaware River, which has long been the greatest location for the manufacture of explosives, with the center at Wilmington, Delaware. The great danger of explosions causes the plants to be removed from city limits to isolated locations often in or on the edge of swamps. Among the raw materials for this industry nitrate of soda is important along with nitric and other acids, sulphur, and charcoal.

The Products of the Electric Furnace.—Another group of chemical products meriting mention here are those produced by electricity or electro-chemistry. The great heat of the electric furnace is used in the manufacture of a number of crystalline substances produced by the cooling of fluids made by the melting of refractory substances in the consuming heat of the electric spark. One of these is called carborundum, and is made by fusing coke, glass, sand, and sawdust, the resulting crystals being carbide of silicon and resembling black diamonds. Pieces of carborundum are useless as gems, but exceedingly valuable when cemented together or made otherwise usable as

abrasives for the cutting of metal, stone, glass, or wood. Another of these products is alundum or artificial emery; and for making non-fusible retorts, the artificial graphite from Niagara Falls furnaces now far exceeds the output of the mines in the Adirondacks.

Calcium carbide is another product of similar process of manufacturing, namely the fusing of materials under the great heat produced by the electric current. This material in combination with water produces the brilliant acetylene gas now so well known. It is manufactured at Sault Ste. Marie, Michigan, and at Niagara Falls, where the great power plants, run by the waterfalls, produce also all the carborundum made in America. These same products are produced in Norway and Sweden, where the moist Atlantic winds blowing against the high mountains give excellent water power for the production of cheap electric current, which seems to be the locating factor in this industry, which is assuming large proportions, and in which Scandinavia and Switzerland with their riches of water power plants have such a surprising lead in exports, as shown by the appended table.

CALCIUM CARBIDE

Countries	Made	Used	Exported
Sweden and Norway	52,000	4,000	48,000
United States	50,000	37,000	13,000
France	32,000	31,500	500
Switzerland	30,000	4,000	26,000
Italy	28,000	23,000	5,000
Austria and Hungary	22,500	17,000	5,500
Canada	12,000	8,000	4,000
Spain	18,000	16,000	2,000
Germany	7,000	36,230	
England	2,000	16,000	
Other countries	5,200	63,800	

Norway alone has 60,000 horse-power employed in making calcium carbide and 40,000 horse-power in other electro-chemical work.

[14]2. SUGGESTIVE MINOR CHEMICAL INDUSTRIES

[“Es]sential oil” is the name applied to oils that are charac[teristi]c of particular plants. Thus the cinnamon flavor is in [an es]sential oil which can be entirely extracted from the cin[namo]n bark. Essential oils enter largely into drugs, medicines, [perfum]es, and flavors. The extraction is sometimes by distilla[tion, s]ometimes by other processes. The production of these [is] a combination of agriculture and chemical manufacture—[agricu]lture furnishing the raw material. Orange, lemon, and [bergam]ot oil are citrous products made chiefly in Sicily and [Calab]ria, where the fruits are cheap and labor abundant. [Bay] oil comes from Montserrat and other West Indian islands. [Ind]ia exports a number of seeds producing essential oils, [and C]hina ships, largely through Hong Kong, nearly a million [dollar]s a year of aniseed and cassia oils.

[Ano]ther class of these oils appears in perfumery. The growers [of Da]mascus roses in Bulgaria give to the western world its [suppl]y of the precious attar of roses. Its costliness results [from t]he payment of from three to five cents per pound for the [rose]s, of which from 160 to 225 pounds are required to distill [an ou]nce of the attar.

[The] Riviera, the warm, sunny, rocky coast of the Mediter[ranea]n near the Franco-Italian boundary, has a dense population, [a clim]ate good for flowers, and the tiniest patches of arable [land a]long the cliffs. Here a perfumery industry thrives, with [associ]ates of orange perfumers and jasmine growers. Oil of [gerani]um and oil of violets are also distilled here. In south[ern]n England lavender oil is made from the cultivated lavender [plant], and a recent entrant into the perfumery trade is the oil [of l]aloe, made from a wood growing on the highlands south[east o]f the city of Mexico. Essential oils are merely one class of [chemi]cals and drugs. There are also numerous vegetable [produc]ts other than oils, such for example as nux vomica and [strych]nine, the products of a bean yielded by a tree growing [i]n the forests of India. The few oils and extracts men[tioned] here are suggestive of the rapidly widening use of a class [of pro]ducts in which discovery has but begun, and in which [cultiv]ation and manufacture follow on the heels of demand [made] effective by new laboratory processes.

Two great industries of a chemical nature, fertilizer and soap, demand particular discussion because of their intrinsic importance and also because of their importance in enabling us to understand other industries.

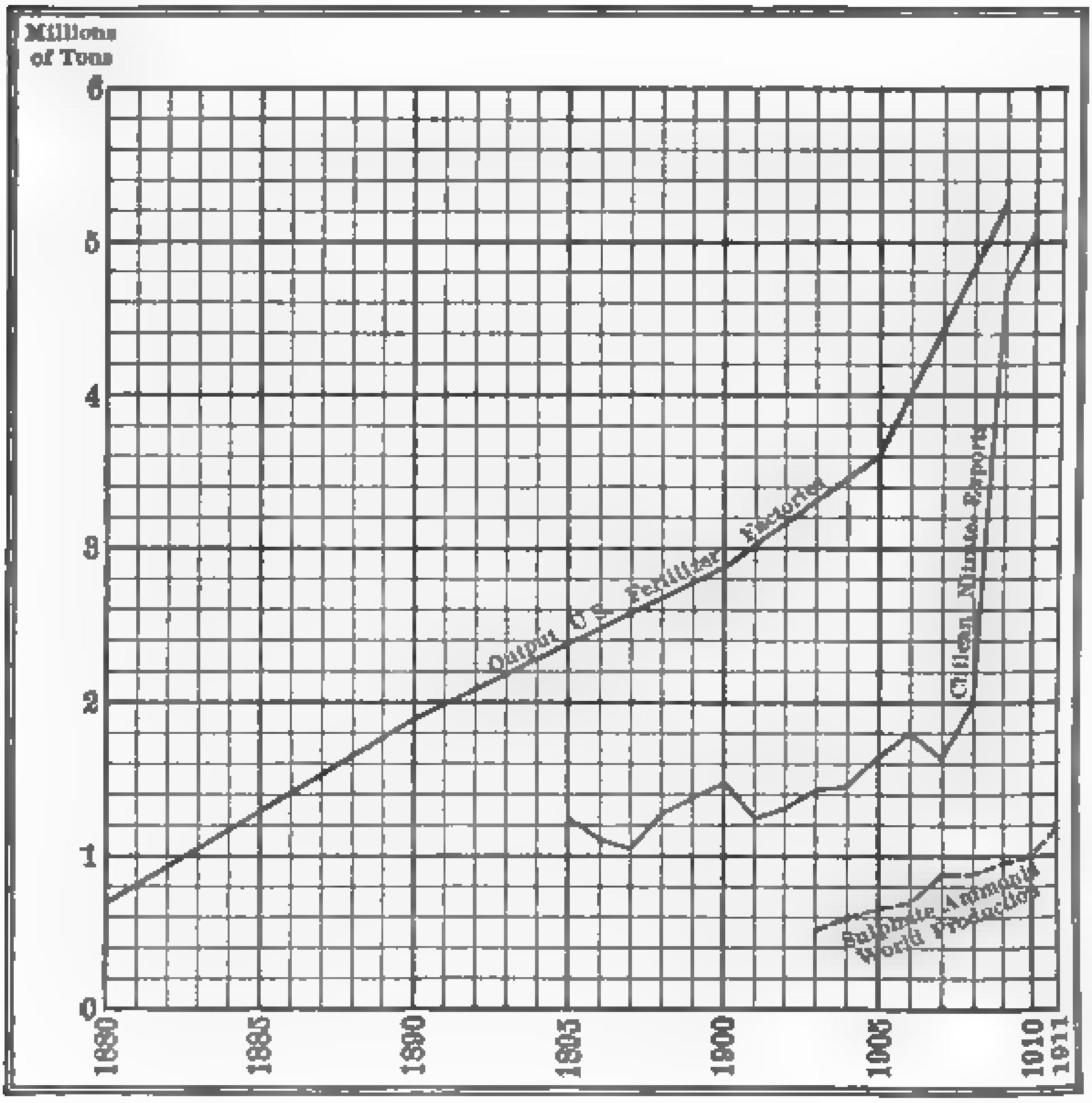

FIG. 187.—The increasing output of fertilizers.

3. THE FERTILIZER INDUSTRY

The heaviest of all chemical industries is that devoted to the production of chemical plant foods known as fertilizers. Of the several important chemicals necessary to the growth of plants, three—namely, phosphorus, potassium, and nitrogen—often exist in the soil in insufficient amounts or in unavailable forms, and

often must be supplied. These three substances in many different forms and commodities are the main raw materials of the fertilizer manufacturer, and he ransacks the world to get them.

Guano.—The first article extensively used as a commercial plant food was guano, the excrement and dead bodies of sea birds which have lived and nested in places where the rainfall is insufficient to dissolve and carry away the deposits. Of all the accumulations of valuables upon the surface of the earth, none have been more productive of easily gathered wealth than the guano beds of the rocky Chincha Islands off the desert coast of Peru, where for unknown ages myriads of sea birds had lived and nested. Upon the discovery of the value of guano, these islands became a mine rich with the newest fossil accumulations, and yielding between 1830 and 1880 about $600,000,000 worth of valuable plant food (nitrogen and phosphorus) which was chiefly taken around Cape Horn to Europe and America, and sold at from $30 to $60 per ton. As the taxation of this industry was most easy, it was for a long time the support of the Peruvian Government; but the exhaustion of the deposits has caused the industry to decline to an annual harvest of a few thousand tons per year, of which the larger part is used in Peru itself. Small amounts of guano are still exported from the west coast of South America and from some of the drier West Indian and other tropic islands, but its place as a fertilizer has, since 1880, been quite largely filled by chemicals from widely different sources.

Phosphates.—The bulkiest, cheapest, and possibly the most important of these rival plant foods are phosphates, which furnish phosphorus to the plants. Much of the phosphorus of the world has been concentrated as phosphates in the bones of animals. Consequently, it is from animal sources, directly or in fossil form, that nearly all available phosphorus is obtained. Thus, ground bone is an important fertilizer, and for many years the bone hunters, with their wagons, roamed the western plains of the United States, getting these last remnants of the buffalo and cattle that had perished in blizzards, by the wolf pack, or by the hand of the hunter. Ship loads of bleached bones are picked up on the plains of the Argentine Republic and shipped to the fertilizer plants of the eastern United States

and Europe. The small butchers as well as the great slaughter houses of our large cities also furnish their contribution.

But by far the greatest amount of phosphorus is now obtained by man from the fossil remains of animal life, known as phosphate rock, from which, by chemical process, fertilizers are made.

Fossil Phosphates.—No other country approaches the United States in phosphate rock resources. The lime phosphate rock in this country is usually found so near the surface that it can be dug from pits. This industry started near Charleston, S. C. This state had a monopoly of this industry from 1867 to 1888, but its greatest development now is near Tampa, Florida, which state produced four-fifths of the entire output of 2,600,000 tons in 1910. New discoveries have been made in central Tennessee, and recently deposits of great extent have been found in the arid plains near the boundary of Wyoming and Idaho, not far from the Yellowstone National Park. The mining of these western deposits has scarcely begun, and the location lacks the advantages of water transport that are so helpful. In addition to supplying the American market, we export over a million tons a year, chiefly to England, France, and Germany. The port of Tampa alone sends about half of the product, St. Marks and Fernandina, Fla., each one-fifth, while smaller quantities are shipped from Pensacola, Fla., and Savannah and Brunswick, Ga. Some phosphate rock is produced near Liege, Belgium, and also at Estremadura, Spain, and Cambridgeshire, England. In Ontario and Norway there is some produced in the form of a mineral called apatite.

The phosphorus only becomes available as plant food after it is dissolved, a service which sulphuric acid renders in the factory, making the so-called acid phosphate.

Of late years the so-called basic process of purifying iron and steel has given us a new source of phosphorus. The limestone linings of the furnace draw the phosphorus from the molten iron and steel, and are later ground up and sold under the name of Thomas slag or basic slag, quite largely used as fertilizer in England and Germany. It is used less in the United States because of our fossil phosphates. The greatest seat of its manufacture is Germany, whose exports amount to nearly half a million tons, of which we imported but 13,000 tons.

Potash.—The second great raw material in the fertilizer industry is potash, of which we are heavy importers (586,000 tons, 1911) from Germany, which country has, under present conditions, almost a world monopoly. Potash differs from phosphorus in that there are vast quantities of low-grade material as a possible future dependence. Mountains of feldspar in various parts of the world contain about 8 or 9 per cent of potash; but it is unavailable under the existing state of chemical knowledge. So the whole world depends upon the mines of Stassfurt, near the Elbe River, in Germany, where, overlying a large deposit of common salt, is to be found the only important collection thus far known of available potash salts, of which there are several varieties. This collection of natural chemicals makes Stassfurt possess the greatest variety of chemical works to be found in any city of the world. From it the materials of the soap-maker, the bleacher, the glass-maker, the dyer, the photographer, the potter, the gunpowder manufacturer, the fertilizer manufacturer and the druggist go forth in great variety. The adjacent town of Schoenbeck, upon the Elbe, has the largest salt works in Germany. The potash mines of Germany are controlled by a trust, which distributes the product at a rather high price throughout the commercial world.

The exactions of the German Potash Trust, backed up by the German Government, have caused the United States Government to make formal search for this mineral, which, along with tin, has long been the most conspicuous shortage in our wide variety of natural resources. In 1911 great interest was aroused by the discovery in the old bed of a dry California lake of a deposit of potash variously estimated at from four to ten million tons. There is small prospect, however, that this deposit can even stop the increase in our imports from Germany. Much more promising is the potash from Kelp or sea weed, of which several hundred square miles exist off the Pacific coast of the United States. Conservative estimates place the output of 100 square miles of this kelp at 1 million tons of chloride of potash worth $35,000,000 per year, or nearly twice our present imports from Germany. This output provides for the permanence of the beds which feed upon the exhaustless chemicals of sea water. This accounts for the high yield, $50 per acre, year

after year upon thousands of acres, which puts agriculture to shame (*Year-book*, U. S. Department of Agriculture, 1911, p. 106). The manufacture of this potash has begun in California, Scotland, and Norway, but its technique is to be worked out. It is difficult to conceive of a trust monopolizing this sea-bottom product which belongs, like fish, to the catcher.

Nitrogen.—The third, and most expensive, of the fertilizing materials is nitrogen, of which, despite the apparent scarcity, there are many and unlimited possibilities of output, because this rather inert element comprises three-fourths of the air, and we can draw upon it as we do upon water. Until recently we have had to draw upon the indirect sources of nitrogen. All animal matter is more or less nitrogenous, and fertilizer factories receive as raw materials the inedible animal products from the butcher shop and the slaughter house. Dried blood and tankage, the general refuse collection of otherwise unusable animal material in a slaughter house, are high-priced fertilizers. Dried fish and fish scraps and dried crabs are also important nitrogen fertilizers, especially in Japan. In that country bean cake also has long been used. This cake remains after oil has been extracted from the bean, and is much like that which remains after oil has been made from flax seed and cotton seed, which has been used for fertilizer in this country. The use of these seed-cake products as fertilizer is declining, because of their greater value as animal food, and the high fertilizing value of the animal excrements. Fish and other animal remains also contain some phosphorus.

Nitrate of Soda.—The greatest nitrogen-supplying raw material at present is nitrate of soda, which, like guano (and probably potash also) accumulates in commercial quantities only in deserts, where the rainfall is insufficient to dissolve and carry it away. Small quantities come from the deserts of northern India; some is produced in Death Valley, California, and the other deserts of California and Nevada, where it is found in small quantities as a white crust along with borax on or near the surface of the earth, and only needs to be hauled away and refined. The California[1] borax supplies the 40,000 tons a year necessary for

[1] Recently discovered borax mines have so reduced the price of borax that it is no longer gathered from old lake beds.

nited States, but the supply of the nitrate in commercial ities is practically a monopoly of Chile.

› northern third of Chile is a desert, as absolute a desert, of it, as the world possesses. Here, in the desert plateaus en the Andes and the ocean, near the Tropic of Capricorn, st amounts of nitrate of soda—soluble riches which a decade n would dissolve and carry to the sea. The method of g this treasure of nature is simple. After the removal of a sand and earth from the surface, it can be shovelled up like nd gravel and taken away in carts or temporary railways › nitrate works, where it is refined. This is done by disg it in water, then boiling down the solution, from which itrate crystallizes, as sugar does from the cane juice. A oduct of the nitrate plant is iodine, and Chile having a cal world monopoly of both nitrates and iodine at the presime, limits production and prices almost at will. The sion of this valuable monopoly has profoundly influenced n industry, government, finance, and trade.

rate Cities in the Desert.—The prosecution of this industry desert of northern Chile gives rise to an interesting coml situation. When shipments of nitrate first began, the along this coast even brought their water from more d ports from which water ships regularly sailed northward outhward, replenishing their tanks at each end of the y. As the nitrate industry has grown and become firmly ished, the nitrate towns have been enabled to secure a supply by laying pipe lines to the Andes, sometimes more 100 miles away. But the desert destroys all possibility of cal food crops. Everything for the use of man and beast be imported, so that Iquique, the nitrate metropolis, a city ut 50,000 inhabitants, and many smaller towns and nitrate , are depending upon the farms of central Chile, several ed miles to the south of them, for every potato, cabbage, f hay, or loaf of bread, necessary to support the daily life se thousands who are extracting from the desert the nitrate ulations of the past. The same conditions of foreign rt apply to the nitrate, manganese, and borax works in ame vicinity but across the boundary in southwestern a. These desert colonies with the mineral products give

rise to a curious triangular trade by which the desert miners sell minerals in Europe, while Europe sends manufactures to central Chile to pay for the food and forage sent thence to the dwellers in the desert.

Nitrate of soda alone comprises about three-fourths of the Chilean exports, and amounts to an annual total of nearly 2,000,000 tons, approximately a freight ship load every day in the year. Copper and iodine, from the same desert, comprise one-third of the remaining exports. The greater part of the nitrate goes to France, England, and especially to Germany, where it is one of the greatest chemical raw materials. The United States is also a heavy importer to the extent of 300,000 to 400,000 tons annually.

Manufactured Nitrates.—The nitrate supply of Chile is variously estimated at a quantity sufficient to last the world a few decades or possibly a century, but fortunately this monopoly is destined to pass not into a world famine, but into an era of plenty through new inventions. Sulphate of ammonia yields approximately as much nitrogen pound for pound as does nitrate of soda. It is one of the by-products of coal distillation, and the total output of about 1,200,000 tons in 1911 (United Kingdom, 384,000 tons, Germany 418,000, United States 115,000, France 60,000, Belgium and Holland 43,000), is about half that of the nitrate product and has doubled since 1903. The more economical utilization of our coal would enable the United States to make a half million or a million tons of this product. While the coal will be exhausted some day, the air and waterfalls will not. The air is our ultimate source. In 1910 (U. S. Con. Rep., May 16, 1911) Germany imported 11,000 tons of manufactured sodium nitrate and calcium nitrate from Norway, and plants then under construction would raise the product of Norway to 330,000 tons per year. This is a product of the illimitable atmospheric nitrogen, caught in the electric furnace by the electric spark from a hydro-electric current, produced by German capital in the defiles of the Norwegian mountains. Yet another nitrogen supply, much like nitrate of calcium in analysis and manufacture, is cyanamide, of which the manufacture has been started at Niagara Falls after its production had reached a considerable amount in Norway and France, where water power is cheaper than in America.

The Fertilizer Industry and Its Location.—It is plain why the fertilizer plant, drawing each of its staple raw materials from a different continent, finds the best location upon navigable arms of the sea, so that a ship load of potash from Germany, or bones from Buenos Ayres, or nitrate from Iquique, or fossil phosphate from Tampa, can be unloaded direct from ship to factory. We thus find fertilizer plants established in or near almost every Atlantic port from Maine to Florida. Here fertilizer plants are also near their greatest market. Since fertilizers are so largely used by the truck-crop growers throughout the Atlantic plain and on nearly all farms east of the Alleghanies, fertilizer manufacture is essentially an eastern industry. Georgia is the leading state in the manufacture, chiefly because it is an important cotton state, and the exhaustive one-crop plantation system of growing cotton makes the use of chemical fertilizers imperative.

In new countries the soils are usually fertile enough to make unprofitable the use of fertilizers, and in the United States their use began in the older east and is now steadily going westward into the Central States. The manufacture is rapidly on the increase in Ohio, Indiana, and as far west as St. Louis. Upon the more valuable and carefully cultivated lands of western Europe, particularly of England, France, Germany, Holland, and Belgium, the use of chemical fertilizers is very general, and their manufacture is relatively a more important industry than in this country. By the aid of chemical fertilizers lands in Holland, Germany, and the United States Atlantic Plain previously worthless have been made productive.

The Future of Fertilizer and Fertility.—We are just entering the era of artificial fertilization especially in the United States, because we have an increasing population, soils of decreasing fertility, and the new science of agriculture which is being disseminated with great rapidity. The comfort of our future depends upon commercial fertilizers more than upon coal or iron. Granted the ability to grow plants abundantly science can probably adjust and meet man's wants, but without plants, nothing. Without any one of the three constituents, potash, phosphorus, or nitrogen, a field rich in every other requisite of plant growth lies barren. Even the careful Chinese have to abandon otherwise good land where they can get no fertilizer. It is therefore

fortunate that we have, even without the aid of the nitrogen-gathering bacteria upon plant roots, unlocked indefinite stores of nitrogen and potash. With phosphorus it is otherwise. Speaking in terms of generations its supply is scanty and no ultimate reservoirs are yet in sight. Phosphorus is therefore probably the point of man's weakest hold upon the earth, and its waste in sewage, the loss of animal manures, and soil leaching, is a form of resource destruction with which the future must deal unless perchance we can open some avenue of phosphorous recapture from the great reservoirs of the sea.

4. SOAP-MAKING AND ITS MATERIALS

Soap is produced by the action of soda or potash upon fats. This chemical reaction causes soap manufacture to be classed among the chemical industries. In the United States the product amounts to over $100,000,000 per year or something over a dollar per person, and in Europe it is nearly as important. There is a considerable international commerce in soap (United Kingdom exports $10,000,000 worth of it per year), but a much greater commerce in its raw materials. Oils and fats used in soap making, like many other raw materials, seem to be of especial importance in countries of comparatively undeveloped industry. Tallow, olive oil, cottonseed oil, oil of sesame from India, groundnut or peanut oil, and coconut oil, are all the basis of large commerce. Many other fatty substances of animal and vegetable origin are also used, even including the grease that is removed from sheep wool in preparing it for the loom.

Tallow, Olive, Cottonseed, and Peanut Oils.—Tallow, the standard fat of northern countries, has for a century been the product of the most remote sheep and cattle pasturing districts, and it comes to-day from the sheep ranches of Falkland Islands, from those of New Zealand, and from central Asia, as well as from slaughter houses in our big cities. Since the coming of soap olive oil has been the standard soap fat of Mediterranean countries; and Marseilles, with a soap industry one-seventh as valuable as all of the United States, is probably the greatest center in the world for the handling of vegetable oils and fats. It is located near the French olive district. It is also the natural gateway to northern Europe for the olive oil

shipped in small vessels from the numerous parts of Spain, Italy, and north Africa. In recent decades new industrial movements have given other oils as rivals of, and substitutes for, the oil of olives. Marseilles, the oil center, has attracted this trade also, doubling the output of her vegetable oil mills between 1905 and 1910. One of the most important of these new materials is cottonseed oil, produced chiefly in the cotton districts of the United States, and in its purer grades, largely used for food in south Europe as a substitute for olive oil, while the lower grades serve as a soap material in the Marseilles markets and factories. The opening of the Suez Canal enabled this French port easily to import new oils from the East, and the fat seeded leguminous groundnut or peanut (see Chapter V) is largely imported from Pondicherry, India; from the French colony of Madagascar; from Mozambique, east Africa; from German East Africa; from Senegal in west Africa; and also from Brazil, Argentina, and Costa Rica. The great market for all these producing districts is Marseilles where peanut oil, like cottonseed oil, is a rival of olive oil for both food and soap.

IMPORTS OF OIL MATERIALS AT MARSEILLES

Articles	1906, tons	1910, tons
Sesame seed	61,416	90,979
Groundnuts:		
Shelled	111,158	199,774
In shell	78,677	148,242
Linseed	19,634	10,128
Rape and ravison	3,191	5,483
Poppy seed	3,925	1,794
Castor seed	13,554	13,487
Pulghere seed	....	1,887
Cottonseed	18,391	11,655
Niger and kapok seed	2,375	1,788
Copra	109,914	171,423
Palm kernels	4,170	1,629
Mowrah, illipe, etc	6,431	7,410
Total	432,836	665,679

The list of imported oil materials shows the extent and phenomenal growth of the industry at Marseilles which crushes 90 per cent. of the oil seed imports it gathers from many lands. It will be noted that the great increase is in the tropic products of peanuts and copra.

Coconut Oil.—The coconut, one of the most promising of all oil producers, thrives upon the tropic sea shores almost everywhere, but the largest producer of the nuts upon a commercial scale is Ceylon, where the natives have numerous small

Fig. 188.—Coconut palm is one of the great automatic food machines. There is a saying in the tropics that when a man gets his cocoanut grove started he hangs up his hammock. (U. S. Dept. Agr.)

coconut plantations and Europeans have made large plantations. Ceylon, with the size of West Virginia and the popula- of California and Oregon, has nearly as large a proportion of her area in coconuts (1,035,000 acres) as the United States has in corn and wheat. Coconut meat (copra) is a very durable product when dried, or even when allowed to lie upon the ground, so that it is an admirable commercial product for the easy-going tropic native, who can pick up his crop and dry

it ready for the oil press when it suits him. This oil material is an important export from the Philippine Islands, from the Malay Archipelago, from Madras, Malabar, and Coro-Mandel in India, from the east coast of Africa and the Indian Ocean Islands of Mauritius and Seychelles. The coconut is most important, however, to the South Sea Islanders, to some of whom it directly supplies an amazing variety of wants and furnishes the only means of purchasing the products of the outside world, which come to them in small vessels, veritable floating department stores that skirt the populous archipelagoes trading for coconut meats and coconut oils, which finally find their way to the European soap factories—at Antwerp, Liverpool, Hamburg, and Marseilles. One of the leading manufactures of Sydney, the metropolis of Australia, is the new branch of a British soap company. The plant crushes 1,500,000 coconuts per week. The annual harvest of 23,000 acres of palm groves is brought to it by steamers which scour the Pacific from Christmas Island on the east to Solomon Islands on the west, including Fifi, Samoa, and Tonga. Some of these islands are never visited by any other ships. This one plant at Sydney makes soap, supplies Australia with coconut oil, exports much to Europe, and also has as by-products glycerine, and oil cake for cattle food. From New Caledonia comes the complaint that the natives can make a living so easily gathering up a few tons of coconuts ($100 per ton for copra) that they do not care to work for white men or dig in the chrome mines.

Coconuts are also shipped from Jamaica and Trinidad to the United States, and these places are so near the market that the nut arrives fresh and is used for food, leaving the soap factory supply to come from more distant localities.

Palm Oil.—Marseilles, Liverpool, Antwerp, Hamburg, and other centers of African trade are now receiving large and ever-increasing quantities of a comparatively new soap and candle fat. It is the oil of the palm, the olive of tropic Africa—exported from the west coast, between the upper part of the Gulf of Guinea and Fernando Po, from the east coast between Zanzibar and Pemba, near the Tropic of Capricorn, and also from the shores of the African lakes. The breech-clothed African climbs the 30-foot palm tree and cuts off its head of fruit, as big as a

basket. The many small fruits are boiled, thrown into a kettle of water, and tramped by bare feet to crush out the oil, which is skimmed from the surface of the water. This is refined by further boiling, and used throughout much of Africa as a choice morsel of food, a substitute for the olive oil of Europe and the butter of America. It is also the chief money crop of West African countries and is one of the important articles of freight for the many steamers that skirt the African coast. The kernel of the seed is also quite largely exported for the manufacture of oil in European ports.

The Soap Industry.—The great slaughtering industry of the United States makes its inedible grease into soap materials. Of late the progress in the fuller utilization of by-products has given increasing importance to the manufacture of soap by firms that began as slaughterers of meat animals. The soda ash factories of New York and Michigan produce most of the other raw materials required, and soap manufactories are quite generally distributed throughout the manufacturing parts of the United States from Chicago to Boston; Philadelphia, Cincinnati, and Chicago being especially important. Our riches of animal fats combined with our facility in invention and discovery have given us a large soap industry. Consequently, although we import a few hundred thousand dollars' worth of valuable toilet soaps from Europe, we have come to export thousands of tons of cheaper soap of much greater total value to Europe, and to almost every country in the world.

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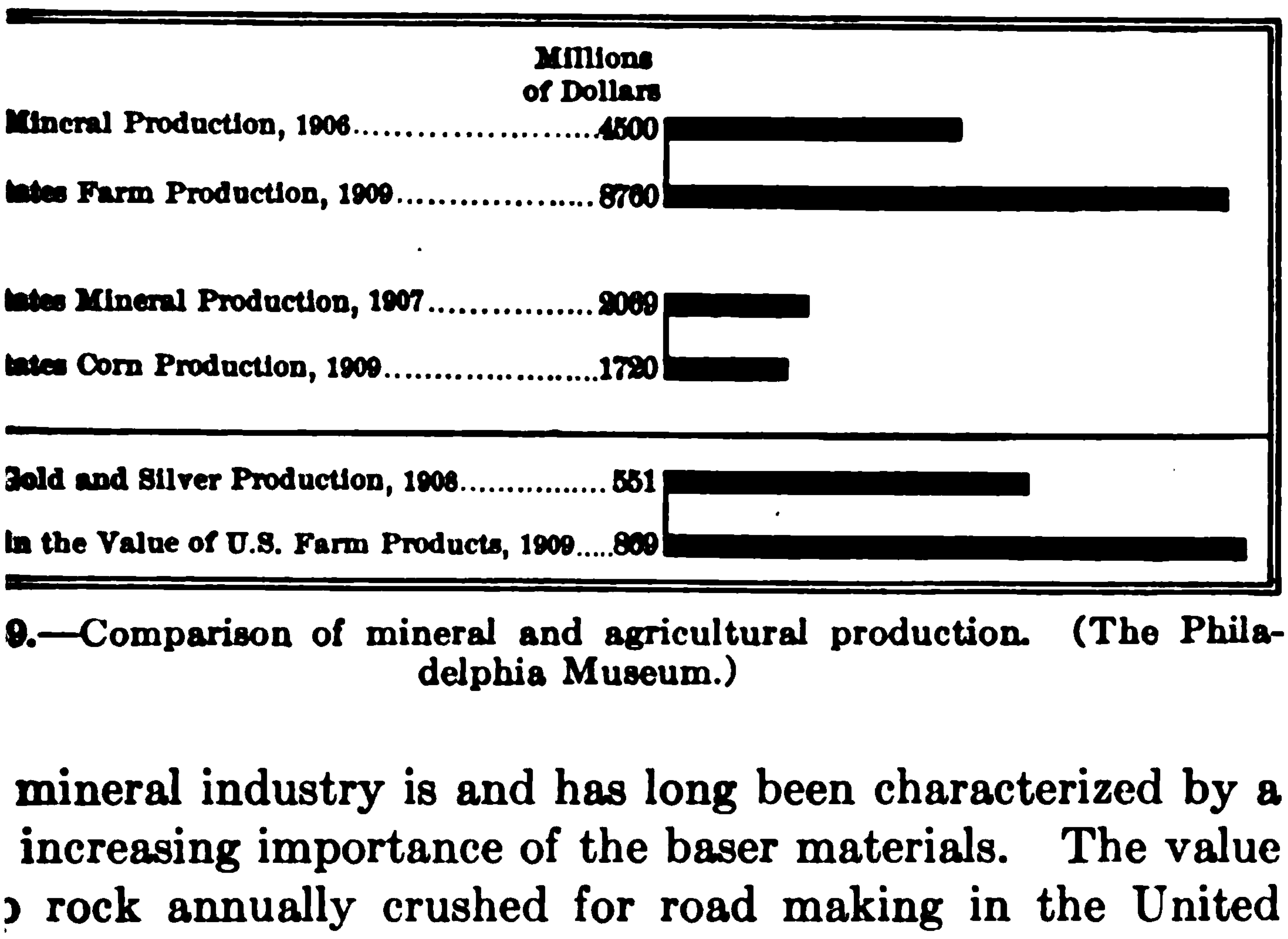
CHAPTER XVI

THE MINERAL INDUSTRIES

mines and quarries of the world were estimated to employ 9 about 6 million persons and give an output valued at ,000,000—a total less than half as great as the output of :an farms. Nineteen forty-seconds of the total value was nd coal and iron together made more than half of the total.



9.—Comparison of mineral and agricultural production. (The Philadelphia Museum.)

mineral industry is and has long been characterized by a increasing importance of the baser materials. The value rock annually crushed for road making in the United is greater than all the gold output of the world in the rush that followed the discovery of America.

1. BUILDING MATERIALS

scarcity and a resulting increase in the price of wood that with the twentieth century forced the people of America, lose of older countries, to find building materials in the crust. After our nineteenth century saturnalia of tree ter and cheap wood, we are being driven more and more

to adopt the building materials used in Ancient Rome and used now in most parts of Europe, east Asia and north Africa. It is merely a sign of the declining ratio of land to man that necessarily accompanied the increase of population. Rome had these conditions and cement was more largely used there in the days of the Empire than at any time prior to the present. The result of this turn to the earth materials is seen in a doubled output of quarry products in the United States between 1900 and 1910 (from $36,000,000 to $76.000,000) and the astounding increase in cement manufacture.

Clay in the form of burned or unburned brick has commonly been the first resource of peoples with whom wood was scarce, especially in warm and arid countries. Houses of adobe or sunburned bricks have been widely used from Pharaoh's time to the present, and adobe is still a common house material through western Asia, north Africa, parts of south Europe, Mexico, and some of the Andean section of South America. In these countries the mild winters (freezing tends to disintegrate brick and stone) and small rainfalls permit such a building material to suffice. In the middle temperate latitudes, brick must be hardened by burning to make them endure, and they become by this process more durable even than stone.

The Effect of Bulk and Materials in Locating the Brick Industry.—The low value and great bulk of bricks make them relatively and absolutely expensive to transport. Then, too, the clay suitable for making them is very common, so that the industry is located near the cities that furnish the market for bricks. There are few more widely scattered industries in America. In its wide distribution, the making of common brick resembles dairy farming. Of the total output of nearly $60,000,000 in 1910, forty-three states made over $100,000 worth, thirty-seven over $300,000 worth, thirty-two over $500,000 worth, nineteen over $1,000,000 worth and but five over $2,000,000, and only two over $5,000,000. The regions of high output are the regions of large population—New York, Pennsylvania, and Illinois. Thus, New York, the state with the greatest city population has also the greatest amount of brick manufacture. The industry has its chief development in the Hudson Valley between New York and Cohoes where an eighth of the output of the United

States is made in 135 plants (1910). This locality has abundant clay, and both railroad and river navigation to furnish easy access to the enormous market of the cities about the mouth of the Hudson River.

It is only occasionally that long transportation of brick is warranted because of some special quality of the bricks. Such are the widely disseminated yellow bricks made in Milwaukee, Wisconsin, Winslow Junction, New Jersey, and elsewhere and also the vitrified brick made so largely in the Ohio clay belt. The bricks of special quality above mentioned are for facing fine houses. Others called fire bricks are very resistant to the fusing effects of heat and are used to line blast furnaces and other heated receptacles used in metallurgy. Some of the best clay for this purpose is found beneath the Appalachian coal seams and the most important fire brick center is in the western Pennsylvania coal field.

Occasionally conditions of ocean transportation are such that bricks of no special quality may be taken great distances chiefly as ballast for vessels. For this reason lumber and tobacco ships of the eighteenth century brought back many cargoes of English bricks, which the farmer's otherwise empty wagon hauled surprising distances where they may still be seen in the old colonial structures of the Tidewater region of the Atlantic States. In the same way Belgian and British bricks are yet carried to Argentina. But the brick yard, with its smoking kilns and clay mixing machines that shoot out the bricks by the mile and cut them off into lengths, is usually an industry with a very limited local market.

Building Stone.—Although brick must be manufactured and stone merely taken from the earth, the building stone is often more expensive to use because of the large amount of labor involved in quarrying and shaping stone, or in fitting rough stones together in the wall. The great weight of its product and the widely scattered deposits of stone, make the quarrying industry, like the production of brick, tend to be local, that is, near the consuming markets. Exceptions are found in several places in the United States where stones of peculiar merit or unusual accessibility give rise to large quarrying industries with a distant market. For this reason, Maine,

the Granite State, has important quarrying industries along the sea coast where the scraping glaciers have exposed bare hills of slate, limestone, and granite. These quarries have access to the best possible transportation facilities, namely, that afforded by the sea-going vessels that can practically come to the side of the quarry in many sheltered bays upon the indented coast. Massachusetts, with conditions like those of Maine, is the third granite producer and Vermont is first. Quarrying is more important to this state than any other. Its granite for buildings and monuments is shipped to great distances and its leadership in marble is most pronounced, the output being four times that of Georgia, its nearest rival.

Marble.—In south Vermont near Rutland is one of the greatest marble industries in the world. A splendid marble deposit is almost as accessible to the quarrymen as are the granites of Maine. As in other extensive quarries, the rock is cut and lifted by mechanical methods and the product is sent surprising distances when one considers how many other good marble deposits there are in the United States. There are unused deposits around the Great Lakes, especially Huron, and in many parts of Appalachia. Fine marble is produced in Georgia and Tennessee, and Colorado quarries are now being worked in the sides of whole mountains of white marble. The most famous of all marble districts in the world is that at Carrara not far from Leghorn in Italy. This district has furnished practically all the world's statuary marble for several centuries and, in addition, much beautiful building stone. The American imports of Carrara marble are nearly one-tenth as valuable as the output of America.

Limestone.—The beautiful marble is far less important than more vulgar stone. It is no greater in value than Trap rock, the hardest of all, which is crushed for surface roads. Common limestones, used for road making, railroad ballast, concrete, and building stone are five times as valuable as the marble output. The region of its production is from Pennsylvania (first in output) to Missouri, which is fifth in output. The limestone most in use as a building stone in the United States is the Indiana limestone (Bedford, oölitic), of which the output of nearly one million cubic feet from the two towns of Bedford and Bloomington made up half the limestone building stones of the United

es in 1910. This stone is widely used in eastern states
use of its durable character and the ease with which, when
quarried, it can be sawed and worked into blocks and other

ig. 190.—Marble quarry, Proctor, Vermont. (Vermont Marble Co.)

ed building forms. Upon exposure to the air it hardens.
same quality gives a wide market to the product of some
sandstone quarries.

Although they send their products to great distances, these important quarry centers produce but a small amount of the total building stone, which is commonly dug from the quarry most nearly available to the place of consumption.

European Quarrying.—In Europe quarrying is more important relatively and much more important absolutely than in the United States, for reasons arising from the number and density of population and the scarcity of forests. The quarries of the United States are worked almost exclusively by men who learned their craft in Europe. In quarrying, Switzerland is the New England of Europe. There, as in New England, there is dearth of other resources and great abundance of stone. The solid Alps give abundant supplies of granite, in great demand in the home country and in the Rhine Valley. Rhine boats which bring to Switzerland coal, grain, cotton, and other raw materials for her dense population, take a return cargo of stone for the alluvial lands of Belgium, Holland, and Rhenish Germany, districts entirely devoid of stone. The Dutch dykes which keep out the sea are, in part at least, constructed of Swiss granite brought in the Rhine boats. The quarries of Belgium have given the name of Belgian Blocks to a paving stone of a certain shape. The Belgian quarries exported 140,000 tons of stone in 1907, but they have of late suffered from the competition of Norway and Sweden, which possess fine bare ledges on tide water.

Cement.—Cement is a mixture of lime and clay burned to drive off the water. When wet, the cement absorbs water, hardens and becomes as durable as rock. Experience has proved it to be good for two thousand years. Cement has been known since the Roman times, the people of that Empire having been very proficient in its manufacture and use. From that time to the late nineteenth century, cement was little used and was a builder's luxury. Three new factors, the reinforcing of concrete, the rotary kiln and high priced wood and iron, have combined since 1890 to produce what is called the cement age in America. Concrete, a mixture of cement, sand and broken stone, has been known for ages. It was little better than a good kind of stone and mortar wall. When reinforced by having a kind of skeleton of steel wires or steel rods within it, its strength is greatly increased and it becomes a substitute for stone, for iron,

for steel, and even for lumber, and can be used to build an entire house. New uses for it are being found continually and in great numbers. The new uses brought increased consumption and the demand for cheaper processes of manufacture brought the invention of the rotary kiln which has cheapened production. Cement has declined in price at the same time that its rivals, steel, iron, and lumber have increased in price. The resulting

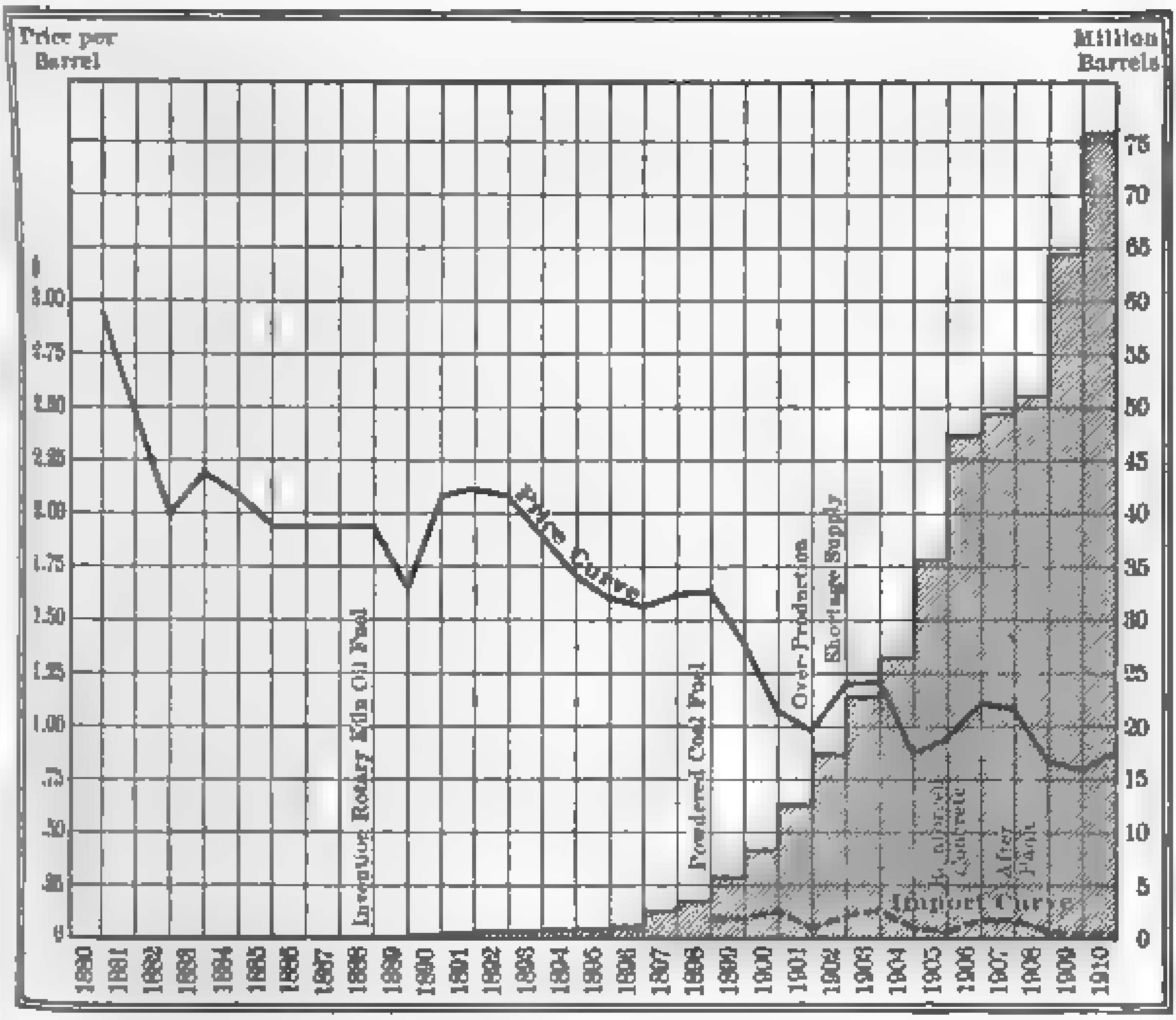


FIG. 191.—Price, production and import of cement in United States. (After R. Malcolm Keir.)

unprecedented increase in the industry has been one of the most sudden of all industrial changes.

It will take us many years to appreciate the full importance of having buildings which will last for centuries rather than those which need renewing in a few decades. At the present time we are losing by fire nearly half as many buildings as we erect and the life of past equipment has at best been short. Concrete buildings are permanent equipment, enabling us to get progres-

sively richer as decades pass. In addition to this great durability, cement has exceptional ease of construction. Building stones must be laboriously shaped, bricks must be slowly laid by hand, but cement is mixed by steam power and poured into moulds with an ease that makes it a natural product of machinery and unskilled labor. The increase in the use to which it is put is swift and will doubtless continue for decades. Among the most suggestive of the new uses may be mentioned cement girders, boats, fence posts, piles for driving into the ground and the replacement of shingles on the Swiss Chalet.

Fig. 192.—The location of the cement plants in the United States shows that the industry tends to be a local one. (After U. S. Geol. Surv.)

The Supply of Raw Materials and the Distribution of Cement Making.—Fortunately the raw materials, limestone and clay or limestone and shale, are to be found in every state and the fuel for burning is also widely scattered so that we have the possibility of having many cement districts if the demand arises. From 1895 to 1905 the leading cement section of the United States was the Lehigh Valley in eastern Pennsylvania. Here the limestone and shale are close together, at the surface, but a few miles removed from the anthracite coal fields and near an abundant supply of good labor (from the adjacent Pennsylvania

erman settlements). In addition to all these advantages of iere production, this field is less than 100 miles from Philaelphia and New York, which are both great markets and also onvenient places for shipment by water to Panama and to ther places where cement is being used in large quantities.

The price of a 380-pound barrel of cement in the Lehigh istrict (Sept., 1912) is $1.20. As a freight rate of $7 per

ig. 193.—Cement is of great service in the management of water. Trail Creek, Yakima Irrigation Project. (U. S. Reclamation Service.)

on will more than double the cost to the consumer, it is plain hat a local plant has a great advantage over distant plants rith the result that Lehigh Valley is making relatively less and ss of the American supply because of competition of newer lants as in the Shenandoah Valley of Virginia, in Georgia, astern Tennessee, Pittsburg, New York, Ohio, Michigan, linois, Kansas, and elsewhere. Like other building materials, ment tends to be a local industry and the map of plants shows to be well distributed over the country, for the freight charge r a few hundred miles is as great as the cost of the cement at

FIG. 194.—Formal opening of irrigation canal and diversion dam on Tr
River, Nevada. Note cement construction. (U. S. Reclamation Servi

FIG. 195.—Cement step down and diversion in irrigation ditch. Young ost
at pasture. Cottonwood tree being killed by girdling.

the mill. The founding of new cement districts, therefore, goes steadily on. It is now being made in half the states of the Union and will eventually come to be an industry in which it will be unusual to market the product at long distances from the point of manufacture.

Cement from the Iron Furnace.—The making of cement from blast furnace slag, with or without addition of other substances, is a recent innovation, important alike to iron and cement makers. Since the disposition of this practically useless by-product of the blast furnaces has been a serious problem at many plants, the making of it into cement is a double advantage and is being extensively carried on at Pittsburg and Chicago, and will doubtless soon spread farther.

Foreign Cement Industry.—Cement making in England, Belgium, and Germany was developed earlier than in the United States. The product is having the same extensive use there as in this country, but our dependence upon European supplies is rapidly falling off due to our large home production. England, Belgium, and Germany for a long time sent some cement to our Atlantic ports, and still ship it to the Pacific coast of the United States because of the very cheap freight rates which can be given by sailing vessels outbound in search of grain cargoes to take back to Europe. Thus the re-building of San Francisco after its destruction in 1906 gave rise to heavy importations of European cement.

The foreign cement industry shows the same wide distribution found in the United States. Agricultural Bulgaria has two plants. Cement is manufactured in Peru and other parts of South America, and even the Far East is practically capable of supplying its present needs from plants in Sumatra, Hong Kong, Canton, on the Yangtse-kiang, at Tientsin and the many Japanese plants in Manchuria and Japan.

POTTERY, PORCELAIN, AND GLASS

Utensils of earth materials were made in most ancient times and by primitive peoples. Pottery is common even among savages, was made by the Indians of America and was left by the Mound Builders. The ancient Egyptians and Phoenicians

rapidly since the Civil War, but the best grades are yet imported from Germany, Austria, and France. Owing to the bulky nature of the goods, they give rise to the employment of much shipping room and store space. Large New York importing houses, many stories in height, handle nothing else. The two cities of Trenton, N. J., and East Liverpool, Ohio, manufacture much the greater part of the good pottery produced in the United States. Trenton alone has more than forty potteries. The supply of raw materials for this city is diverse, like that for the English porcelain industry. The coal comes from the anthracite district of eastern Pennsylvania, and the local clay suffices for the coarser uses of the industry. Quartz and feldspar are brought from the Adirondacks and the southern highlands of New York. Some of the clay comes from distant southern states, the best from Florida. About half of the fine clay is imported from England, being brought back very cheaply by vessels which took out thousands of tons of American agricultural products and must otherwise come back well-nigh empty. From New York to Trenton by canal boat is a journey of only a day and freight cars can deliver the clay to the potteries in a few hours. From Philadelphia, delivery up the river is even easier. In actual practice, the New York canal is little used because of railroad domination. The freight rate from Cornwall to New York is a dollar a ton and from New York to Trenton by rail is another dollar. By wagon it costs a dollar to bring the local clay four miles from the pits. The fuel cost ($3.50 per ton for soft coal) is 50 per cent. greater than all other raw materials and the labor cost is about 85 per cent. of the total. As long as the wages are the same in Trenton and East Liverpool on the coal and gas fields of southeast Ohio, the fuel advantages of that city are not an important factor. Trenton is one of the best places in the United States, if not the best, for a new pottery plant to secure adequate skilled labor and supplies—hence the concentration of the industry.

Ohio is the leading pottery state in the Union. While New Jersey has, in addition to Trenton, only one other small center, that at Perth Amboy, Ohio has in addition to East Liverpool, which produces almost nothing but pottery, the pottery centers of Akron, Zanesville, and Cincinnati, which last city has the distinction of manufacturing the only distinctive kind of American art

pottery. The state of Ohio, with its great variety of glacial clays, its abundant underlying coal and its transportation by lake, river, and numerous trunk-line railroads, is in an excellent position to ship pottery in all directions. It makes one-third of the sewer pipe of the country, and is important in the manufacture of drain tile.

There are extensive deposits of good kaolin in North Carolina, Georgia, and other southern states. Small amounts are dug in Delaware and Maryland, but there is no prospect of the industry moving to these southern supplies of raw material, which can be so cheaply and easily transported to centers of manufacture upon the edges of the coal fields.

China and Japan.—China, rich in china clays, and so long famed for its porcelain, taught the trade to the Japanese centuries ago, and the pupils now rival their teachers in the excellence of their porcelain. This old Japanese industry has long depended on charcoal from the wooded hills and hammers driven by water wheels to grind the clay and stone. The practical destruction of forests in the pottery districts has recently caused the use of coal to be introduced; but fuel is economized by having the ovens placed one above the other upon the sides of steep hills, so that the heat passes from one oven to the next, and is thus made to perform its greatest service. The Japanese porcelain makers, like the other Japanese artisans, were, until a recent date, individual artists, but the quality of their product is declining, because of wholesale manufacturing and the desire to make cheaper goods for the foreign markets. The Japanese porcelain industry is relatively unimportant in comparison with that of England, Germany, or the United States. It is nearly all made for export, which amounts to one-fifth of that of Germany and one-third that of the United Kingdom.

Glass-Making.—The quartz sand and flint for glass-making are commonly melted at about 2,500° F. with an alkaline flux, usually soda, to hasten the melting. Various other fluxes are used; and, in different factories, numerous other materials are added to give particular qualities. The only substance always present is silica, which is usually in the form of pure sand, a product most widely distributed. It occurs in practically all countries. It is claimed that western Massachusetts has the best

in the world; and excellent glass sands are found in New Jersey. Maryland, West Virginia, Pennsylvania, Indiana, Illinois, Missouri, and Minnesota.

The American Glass Industry.—The United States leads the world in the manufacture of glassware. Like iron, the industry began with a wood-burning epoch, which caused it to be centered in New England and the eastern states. In 1776 a glass company established itself at Glassboro on the sands of south central New Jersey, where a tract of 35,000 acres of woodland was secured to produce the fuel. The industry still survives at Glassboro, but coal, amounting to about 25 per cent. of the cost, is now used, while there as elsewhere the packing boxes and barrels are more expensive than the sand, which costs little more than the cost of steam-shovelling and a low freight rate. The $92,000,000 worth of glass made in this country in 1909 used 1 1/2 million tons of sand worth $1,500,000.

There are three important glass manufacturing districts in the United States: the eastern is in southern New Jersey and southeastern Pennsylvania. Millville, N. J., is one of the leading glass manufacturing towns in the United States, and it is followed in importance in the eastern field by Bridgeton, Glassboro, and Philadelphia. These eastern glass centers have abundant sand, but they are at some distance from their coal supply which they use in the form of producer gas. The gas-fed flames play around the pools of melted sand as it waits its final shaping at the hands of the glass blower or glass machine. Owing to the great fuel advantage possessed by the natural gas region of western Pennsylvania, Ohio, and Indiana, great gains have occurred in these states, and the east has gained little in recent years. Muncie, Indiana, is the rival of Millville, N. J., and Gas City, Indiana, has had a great rise in glass making. The exhaustion of the natural-gas supply has centered attention upon bituminous coal as a fuel. As a result the Pittsburg district with both coal and natural gas is now the greatest glass-manufacturing district of the United States, and Pennsylvania makes over a third of the product. The Ohio Valley dominates this industry as it does the iron industry and for the same reason—fuel.

Processes of Glass Making.—For a long time practically the only means of shaping glass was to dip a long tube into the clear pool of

liquid glass and blow through the tube, so that, by whirling and blowing, the expanding bubble of molten glass became, upon cooling, the desired vessel. For window glass it was blown into cylinders, which were cut open and allowed to fall upon a table to cool. Glass blowing is difficult work, requiring very great skill and commanding high pay. During the first few years of the twentieth century, glass-making machines were invented. Some of them do the work with great rapidity; for example, two men working twelve hours a day, or three men, working eight hours a day, attend to machines which will turn out 360 gross of bottles. The machines take the molten glass from the furnace and deliver the perfect bottle. This has so demoralized the glass blowers that they have accepted a 20 per cent. cut in their scale of wages and there has suddenly developed a scarcity of apprentices entering the trade.

Plate-glass is the name given to a product of such special quality that it can be passed between rollers, which give it the beautiful, smooth surface. The greatest plate-glass center in the world has long been in the Belgian town of Charleroi, and a Pittsburg glass company has established similar plants for producing the same plate-glass at a town named Charleroi near Pittsburg.

Glass Industry in Foreign Countries.—It is probably true that the glass industry is relatively more important to the Belgians than to any other people. This small country, but little larger than Maryland and with a population one-twelfth that of the United States, has a glass industry one-third as great as this country. It is located along the edge of the coal-fields of Liege and Charleroi close to sand quarries and soda factories. This district, which has long been the leading window-glass center of Europe, furnishes Belgium one of her leading exports.

Germany is second to the United States in glass production. As in the Pittsburg district, the chief centers are located close to the iron districts, being along the Rhine, and near the coal-fields of Saxony, and Silesia. This southeastern coal-field in Silesia borders the Austrian province of Bohemia, which has long been famous for its colored glass. In the south German States of Bavaria and Saxeweimar, special qualities of glass are made for use as lenses. In the little city of Jena, the Zeiss factory with its highly trained scientific workmen, produces the glass of excep-

tional fineness, which is to be found in the lenses of the microscope or telescope in almost every observatory and laboratory throughout the civilized world.

The French glass industry is located near the northern coal-fields along the Belgian frontier where the town of Baccarat is the center of the manufacture of French crystal glass. The English glass industry is about one and one-half times as great as that of Belgium, but only about one-half as great as that of the United States. The best sands are found along the south coast of England near Hastings and on the Isle of Wight; but the chief centers of glass manufacture are upon the three coal-fields near Birmingham, Bristol, and Newcastle. There is also much manufacturing in London, where the factories have exceptional facilities for easy delivery of the brittle product to the vast market in the metropolis.

Glass resembles pottery in the abundance of its uses and it presents even greater difficulties of transport, but the heat is too great to make it in the tropics, the high heat and suitable fuel are much more difficult to secure than for pottery, so it is not so widely distributed and is not, like pottery, an industry of very primitive peoples. Uruguay has recently opened a glass plant on the banks of the river Plate where the flowing current brings an unlimited supply of properly washed sand. Mexico makes a little glass; but most countries with undeveloped manufactures and practically all the colonial territories are importing their glass from Germany, England, Austria, and, to a lesser extent, from the United States.

Commerce in Glass.—The United States imports some European glass, especially the finest grades for lenses and for fine work, but we also export to many countries certain of our machine-made products, in which we are exporting the products of our inventive ability. Our glass machines are being introduced in the German glass works—a process which will probably tend to cut off our exports.

3. COPPER, TIN, AND ALUMINUM

Machines, power, explosives, chemical processes, and the large corporation have, within fifty years, transformed the win-

ing of the less abundant metals to an extent comparable to the hanges in the making of textiles. In some kinds of mining, perations are on a gigantic scale and the miner is no more of n industrial unit than the weaver. A recent mining enterrise in Nevada expended $20,000,000 in the purchase and quipping of two mines including 141 miles of railroad, a smelter, hree towns, and a concentration plant. This latter marvel ses 6,000 horse-power, crushes nearly 5,000 tons of ore per day and can be enlarged to handle 15,000 tons) at a cost of fifty to ixty cents per ton for milling (crushing). The porphyry ore hat this large plant works has only 2.34 per cent. copper, 0.019 unces gold, 0.07 ounces silver per ton. Of this the concentrating plant with the new concentration processes extracts 7 per cent. of the copper, 55 per cent. of the gold, and 56 per ent. of the silver, the precious metals being worth but twentyhree cents per ton of ore, but yielding over $1,000 per day to he company.[1]

Copper, tin, and aluminum occupy a position intermediate in ost between the precious metals, gold and silver, and the cheap nd common but more important iron. In their industrial se, they are rapidly increasing in importance because of the nany new uses to which invention subjects them. It is a fact umiliating to modern scientists that the ancients were better rtificers in copper than are the moderns who know nothing of he means by which the soft ductile metal was, by the ancients, empered into a splendid cutting tool. The service of copper s coin is very ancient, and at the present time of very great imortance, particularly in India and China, where large quantities f copper coins are hoarded by the natives as a safe and conenient storage of wealth. Bronze, an alloy composed of copper nd tin, is a most durable metal prized alike by pre-historic and y modern man. A mixture of copper with zinc makes brass.

The universal demand for copper in electrical work caused normous increase in the use of this metal in the last quarter entury. This increased demand caused the production of coper approximately to double between 1888 and 1898, and again n the succeeding decade—the total world production now being nearly 1 million tons a year. Constant discoveries of copper ore

[1] *Industrial Progress*, June, 1910.

and new methods of smelting assure sufficient supplies for the immediate future.

This increase in copper production and in our ability to use low-grade ores has been brought about by the very rapid improvement in mechanical devices, which in a few years have increased the capacity of copper smelters from 30 tons to 3,000 tons. The improvements in extracting the metal and hence our increased supply are instanced by the recently acquired ability to use large deposits of porphyry ores that are known to exist in Nevada, Arizona, Utah, and Queensland, but which were of no value at all a few years ago.

The Occurrence of Copper.—Copper usually occurs in combination with many other substances. A single copper mine in Utah, for example, contains silver, gold, and iron. Other mines, especially in Colorado, have the copper in combination with silver and lead.

Sulphur is one of the commonest substances and it is commonly driven off by roasting the ore, which causes the sulphur to unite with oxygen of the air and pass off as sulphurous gases very injurious to the comfort of the people living in the vicinity, and which kill vegetation for miles, as at Butte, Montana. The sulphur of these furnaces can be made into sulphuric acid at a cost, in Tennessee, of $2.75 per ton, but this manufacture was only begun under compulsion as a measure to protect vegetation and there is no market for it at Butte.

THE WORLD'S COPPER PRODUCTION

The new world of copper mining that accompanies the new methods is very different from the world of 1850, as shown by the eighteenfold greater output fifty-nine years later.

The United States, producing but 1 per cent. of the world supply in 1850, when we depended upon the relatively insignificant deposits of the East, now has more than half the world's output and produces more than six times the output of our nearest rival, Mexico, and eight times that of Spain, long the world's great copper producer. Arizona and Montana each exceed in copper output any two foreign nations combined, Michigan's product is 60 per cent. greater than Mexico's.

Michigan Copper.—The upper portion of Michigan was for many years the leading copper producer of the United States and of the world. In the old rocks of this glaciated district, there exists a large copper deposit, unusual in that some of it is pure. This fact, which at first appeared to be an advantage, is often otherwise. The masses are often too large to be taken out whole, the metal too ductile to break with blasting, and the labor of cutting off pieces of pure copper made the cost of mining higher than it would have been had it occurred in the more complex form of ores.

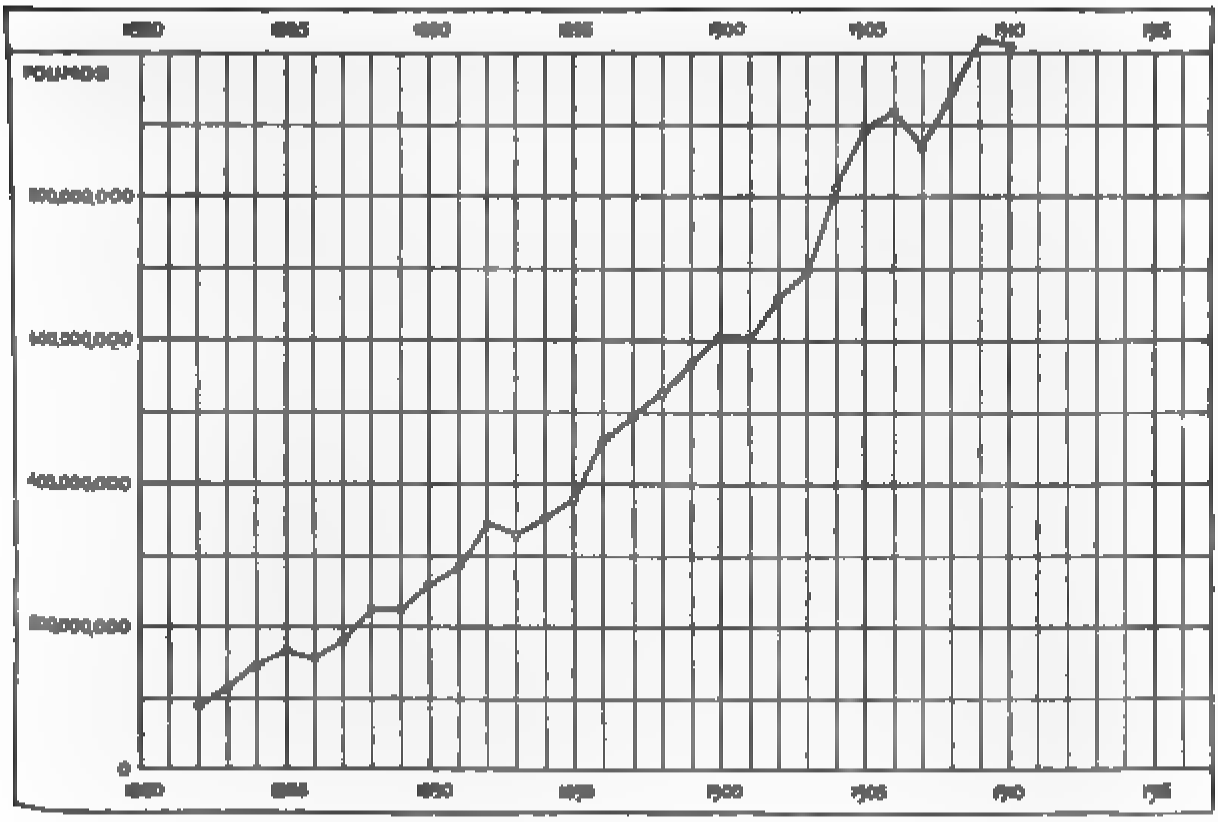


FIG. 196.—The production of copper in the United States from 1882 to 1907 (in pounds).

Easy transportation to this region by the Great Lakes caused early and profitable development of mining. Some of the mines are now a mile deep, their productivity is declining, the output of the district is stationary and shows small possibility of increase before further decline results from the gradual exhaustion of the deposits.

Rocky Mountain and Western Copper Field.—About the end of the last century Montana surpassed Michigan in output. This was due to the one great deposit in the hill at Butte, respon-

sible for the flourishing cities of Butte and Anaconda. The smelter capacity of Butte—250 million pounds of copper per year—is greater than the production of any two foreign countries. At Great Falls, a single smelter has a capacity of 4,500 tons of ore per day and sends its sulphurous fumes from smoke stacks 500 feet high in the effort to avoid contaminating the atmosphere; yet it kills all the trees in the vicinity.

In 1910 Arizona exceeded all other American states and territories as a copper producer, due to recently discovered deposits which now yield one-third of the American output. The smelter capacity in millions of pounds per year of four Arizona towns, Bisbee (129), Morenci (77), Globe (36), Jerome (36) gives some idea of the enormous yield of this metal, which is much more valuable per capita to the sparse population of Arizona than is wheat in North Dakota or iron in Pennsylvania.

Nevada and Utah are apparently just beginning as important copper producers. Recently found Nevada deposits of the newly conquered porphyry ore can be mined by steam shovels as are some Lake Superior iron ores. New smelters are being erected, and the output of the two states has already increased from 50 to 189 million pounds between 1906 and 1910. Colorado copper production comes largely from the town bearing the name of Leadville, and chiefly noted for the production of gold. Much Colorado copper ore is smelted at Omaha, Nebraska.

Arizona copper fields are continued in the adjacent Mexican State of Sonora, where mining progress has been rapid, making Mexico the second copper-producing country. A fifth of all Mexican copper comes from Boleo, in the southern part of the peninsula of Lower California, where for many years a French company has smelted its ore with coal and coke brought from Europe via Cape Horn. Mexico, by nearly doubling her copper production between 1901 and 1910, surpassed all other important countries in rate of increase.

The Import of Copper Ores.—In addition to being the greatest producer of copper, the United States also smelts a great deal of copper produced in foreign lands. This is due partly to our great wealth in the necessary coal and also to the fact that from many sections ships returning, practically empty, can carry the ore cheaply. For these reasons, New York, Baltimore, Norfolk,

ther coast cities smelt hundreds of thousands of tons of r ore brought from Labrador, Newfoundland, Spain, any, Italy, Peru, Cuba, and Canada. Although the metal tined for export, our copper imports are greater than the ned production of any two foreign countries.

World Copper Supplies.—The Old World is at the present deficient in copper output. Europe produces less than a and uses much more than half the world's copper supply. xports of copper from the United States, about one-half of tal product, one-third of the world's supply, amounted in o 400,000 tons, worth over $100,000,000, making it one of ost important of our exports.

in, now next to Mexico in copper production, resembles uthwest in its aridity, in its mountainous character and in ineral wealth. Two-thirds of the Spanish copper output from the Rio Tinto mines, which also furnish in the form n sulphide or pyrite a large part of the sulphur imported he United States. The richness of this great mine is such the cost of operation is only one-fifth the value of the t.

ong the Old World producers, Japan is after Spain the :. Although the fourth country in the world, it is not half ductive as Michigan, the third state in the United States. uch is the poverty of Japan, that copper is one of the most tant metal productions. Australasia, the third Old World cer, has copper fields in the Mt. Lyall district of western ania and in Queensland, in New South Wales and west alia.

th America.—The Pacific coast of South America is rich pper. The desert region of north Chile has a number of r mines, making that country one of the world's important r producers. Although the mines have not produced a amount, few of them are yet worked to any great depth. is also an important copper producer chiefly through the t of the Cerro do Pasco district, upon the high Andean au, which sends its product to the sea by means of the rail- that passes Lima and Callao. This section was until tly dependent upon pack trains.

spective Copper Supply.—The present rapid railroad

development in remote regions promises to bring forth much mining development, copper included. A copper deposit in central Africa, known as the Star of Congo mine, affords an interesting example. Before the completion of the railroad to it, from Beira (1911), mining work was already begun, so that 1,000 tons of copper per month could be extracted as soon as the railroad permitted the erection of the machinery and 5,000 tons of copper per month is expected in a short time. On the Magdalena River in central Colombia, a deposit is reported greatly resembling that of Michigan. Alaska is known to be rich in copper, as is Yunnan, a southwestern province of China, which is reached from British India by rail. The Argentine government had recently expended $1,000,000 in building a twenty-mile cable way which will carry 40 tons of copper per hour out of the Andes Mountains in the province of Rioja. Persia is reported to be rich in copper ore and in the Transvaal, old workings of the unknown ancients are being reopened. As yet only a very small proportion of the earth's surface has been prospected at all carefully for copper and other metals, and the new processes of working low-grade ores have just been perfected. The Caucasus Copper Company is evidence of the probable effect of the new processes. This company, partly American owned, has bought property near Batum on the Black Sea, which was worked several centuries ago by the Genoese. After spending $8,500,000 in experiment and development, the new owners have begun large scale work on a deposit of many million tons of low-grade ore (3 1/2 per cent. copper) resembling that of Utah (U. S. Con. Rep., January 6, 1912).

Tin.—Fortunately, new applications of science to industry have not increased the uses of tin as they have of copper. Such new demand would have created an acute tin famine. Although its production is but one-tenth that of copper, it has increased but one-third in a decade despite a three-fold increase in price between 1897 and 1907. This metal is valuable chiefly because it does not rust, and is, therefore, used as a protective covering for sheet iron and steel in making so-called tin cans, tin roofing and many other articles. It is the only metal of importance to industry, in which the United States is entirely lacking. Our product of a few tons a year from the Black Hills of South Dakota,

from Texas and from South Carolina is and has been insignificant. The tin mines of Cornwall, England, are among the most conspicuous mines in history, as they were worked long before the Christian era, and seem to have been the basis of important trade between England and the Mediterranean countries in the time of the Phoenicians. At the present time these mines are doubtless producing as much as they did in ancient times, but the amount has become inconsequent in the world's total of 100,000 tons, because of the great production by Chinese laborers in the region near Singapore. The southern part of the Malay Peninsula produces over 50 per cent. of the world's supply and the near-by Dutch Islands of Banka and Billiton 12 per cent. additional, also by Chinese labor. Bolivia contributes 19 per cent., Australia 5 per cent., and England but 5 per cent. of the world's supply.

Conditions of Tin Production.—The centuries-old Cornwall mines are hundreds and even thousands of feet deep, but in the Malay Peninsula and adjacent islands, there are large areas bearing alluvial gravels in which the 200,000 coolies work as the individual miner works placer gold. This mining is done very carelessly. The regions promise a great output in the future if the same lands shall be reworked with such a dredging device as that which now reworks the old alluvial gold-fields of Australia. By this device, a centrifugal pump and six or eight men per shift can do as much work in twenty-four hours as do 500 Chinese under present hand methods. Alluvial deposits are usually trivial in comparison to the lodes from which they were washed. The first tin mine on the mother lode in the Malay Peninsula has been opened, and the era of deep mining such as is followed in Cornwall should be long.

In Bolivia, second only to Malaysia, the tin is practically all derived from veins in many mines in the districts of Potosi, Oruro and Uyuni. This region is in the high, dry, and very cool plateau, the mines being between 14,000 and 18,000 feet above sea level, an altitude greater than any mountain peak in the United States or the Alps. Most of the mines are still far from the railroad, are operated by crude hand methods and ore is being carried to Oruro on the Antofogosta line on llamas at forty cents per ton per mile.

The most important single tin district in Australia is the vicinity of Mt. Bichoff, Tasmania, where tin is won from ores, and also from stream beds by dredging.

Supply of Tin.—Although rumors of discovery of tin deposits frequently are unfounded, the discoveries in the Transvaal are especially promising and Nigeria, west Africa, is also believed to be rich in it, as is the Lake Kabele district of Katanga. At the present time some Nigerian tin ore is carried on the backs of men as much as 190 miles to the navigable waters of the Benue, the eastern branch of the Niger, making a freight cost of $60 per ton to the coast. This is an alluvial product, like that of Malaysia. Inasmuch as the thorough processes recently applied to copper have not yet been applied to tin, and deep mining has been limited to Cornwall, there is every reason to think that the deposits now known should yield an increasing output for decades.

Aluminum.—As one of the elements of the earth's crust, aluminum exists in enormous quantities in the ordinary clay. Hence, great hopes for the future are entertained, but the extraction of the element in its metallic form is very difficult, and it thus becomes the newest of the important metals. It is especially attractive because of its lightness, toughness, and non-corrosiveness, being strong in qualities in which iron is weak. It was first manufactured for commercial purposes in 1859, but for twenty-five years the price was $10 per pound and the world's production only 2 or 3 tons per year. In 1907 as a result of new processes of manufacture its price fell to thirty-three cents per pound, and the world's consumption rose.

ALUMINUM

	World production tons	Average price
1897	3,000	35 cents
1902	7,000	31 cents
1907	32,000	42 cents
1910	20,000	22 cents

At the expiration of the patents in 1909, its manufacture was opened to competition and the price fell to fourteen cents per pound, causing the metal to enter upon an entirely new field of usefulness, and permitting only the best plants to keep running, for the manufacture is costly. An aluminum plant at East St. Louis requires one ton of bauxite (aluminum ore), one ton of coal and one ton of very pure limestone to make half a ton of alumina (an oxide of aluminum). This requires further treatment in the electric furnace, a process requiring a large amount of electricity, by present practice about one horse-power for a day for a pound of aluminum. The world's aluminum is, therefore, made easily where power is cheap, namely, the regions of great water-power. Five companies working in Europe are located in the mountainous districts of Savoy, France, of Germany, and of Italy. Some French companies get the water-power for $10 per horse-power per year twenty-four hours per day. One of the American companies has plants in Niagara Falls in New York, using 40,000 horse-power, others in Massena, New York (on the St. Lawrence), using 20,000 horse-power; and Shawinigan Falls, Canada, using 15,000 horse-power. The three American plants with their 75,000 horse-power equipment can manufacture 18,000 tons of metal per year. The world's manufacturing capacity of 50,000 tons is much larger than the present world's consumption, but the new processes, with reduced price, are increasing the demands. For example, aluminum is an excellent transmitter of electricity; more efficient than copper. Now that copper and aluminum are not unlike in price, the possibility of competition at once appears. One aluminum electric transmission line 180 miles in length has already been erected in California. Automobile construction has made great demand for it and aerial navigation is suddenly opening a new field for the lightest kind of strong construction, so that the combination of lower prices and new uses is likely to give us greatly enhanced dependence upon the new metal. It is now cheaper than tin or nickel and the aluminum cooking utensil is as cheap as enamel ware. New alloys are constantly discovered and more doubtless will be, and each new alloy, giving new qualities, widens the field of usefulness.

4. GOLD AND SILVER

On account of their remarkable malleability, durability, and beauty, these metals were highly prized for ornaments and coins even before the period of recorded history. After the discovery of America, the Spaniards' quest for gold led them to remote corners of the New World; this American gold is said by some historians to have been the chief source of the power of the Spanish Monarchy in the sixteenth century and of its later economical downfall.

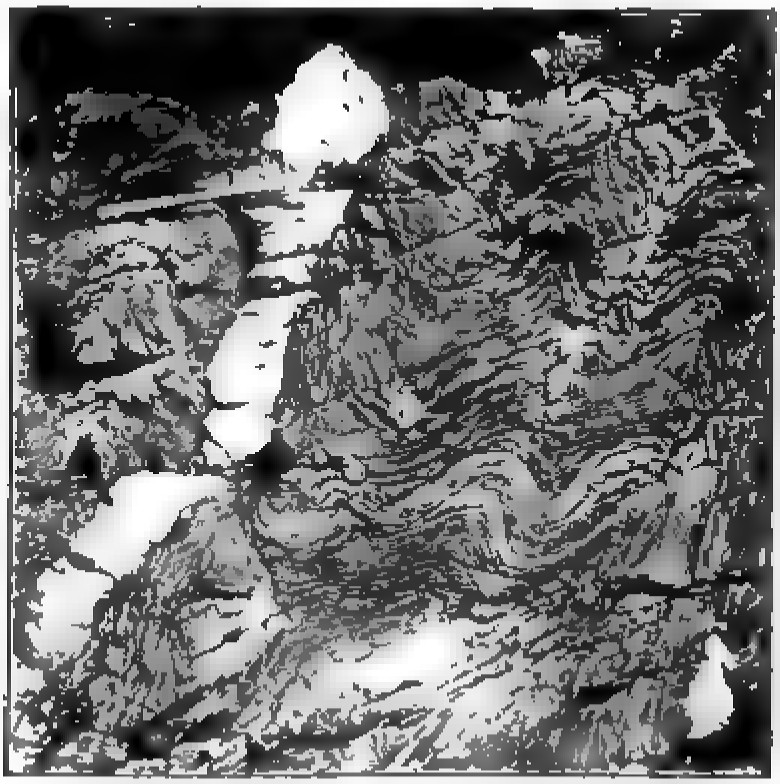


FIG. 197.—A quartz vein (the white band) in metamorphic rock. Muchals Caves, Kincardineshire, Scotland. (From W. S. Tower.) The uncertainties of mining are apparent.

The appeal gold makes to the imagination tends to cause an overestimate of its value. The world's output is of approximately the same value as the corn crop of the three states of Illinois, Iowa, and Missouri in 1911; yet, because of its use as the basis of all our commercial transactions and price, gold production becomes one of the most potent economic influences.

How Gold is Obtained.—Gold, widely scattered in the earth's crust, is collected into veins of quartz in many kinds of rock. The destruction of exposed veins in the wearing down of moun-

tains by streams has caused the transportation of gold along the courses of streams to great distances from the original veins. Sometimes the search for gold along these streams leads the prospector back to the vein or mother lode, from which the stream supply has been eroded. The miner's pan, not unlike a wash basin, suffices to extract the gold from the sand if there be water present in which to agitate the sand until the gold settles to the bottom so that the sand can be gradually separated from it. Large banks of sand and gravel, containing very small quantities of gold, are worked by the placer process, which consists of washing down the gravel banks by the force of a stream of water from a nozzle. The water carries the sand through long sluice boxes, with crevices in the bottom, in which the gold is caught, because, being the heaviest of the materials, it gradually settles to the bottom. This method has been used extensively in many parts of the world, especially in California, where streams have been so choked by débris as to fill up valuable channels in their lower courses and to cover rich agricultural lowlands with worthless beds of sand and gravel. To prevent this destruction of agriculture, California has wisely passed laws which control and often prohibit mining by the placer process. Vast stores of gold are thus made unavailable; but the farm lands which are saved are of greater value to the community since the metal-bearing bank yields once while the tilled valley will yield thousands of harvests.

Dredging is another method somewhat resembling placer mining. It is largely practised in California, parts of Alaska, New Zealand, Montana, and elsewhere. A dredge resembling that used in deepening river channels takes up the earth in front of it, runs it through sluice boxes, catches the gold and drops the earth behind the dredge.

The most permanent kind of gold mining consists in the working of the ores that are found in the veins themselves. The ore is usually ground fine by a stamp mill, and then washed by a process similar to that pursued in placer mining. This process does not, however, get out all the gold, and a newer method called the cyanide process dissolves the gold out of the pulverized ores and makes profitable the use of ores containing as little as $2.50 (less than one-eight of an ounce of gold) per ton and possibly

even less than that. This chemical process has greatly cheapened the extraction of gold from some ores. This and other improvements explain the increased yield which has practically doubled in each decade since 1886 (1886, $106,000,000; 1896, $211,000,000; 1906, $405,000,000; 1910, ($465,000,000).

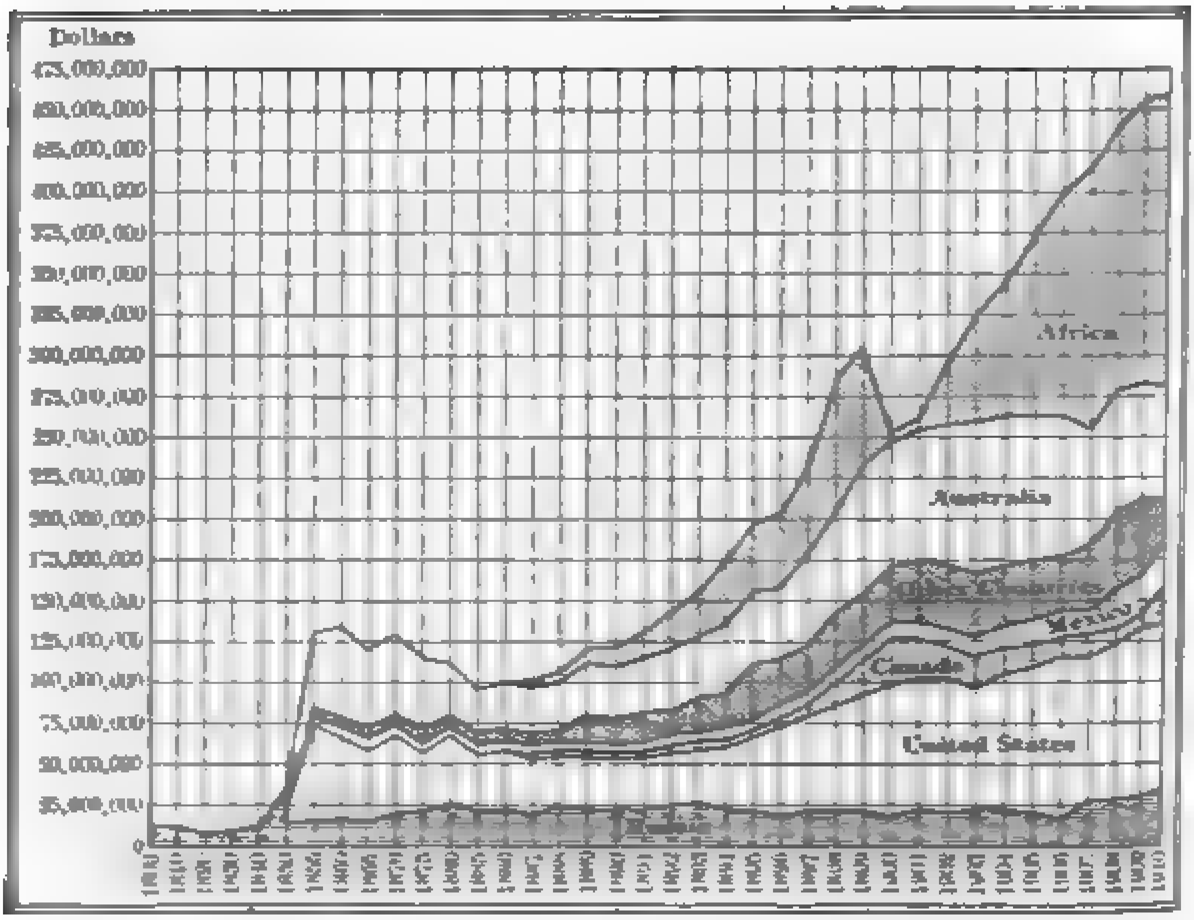


Fig. 198.—Gold production. The world and leading countries, 1800–1910. (U. S. Conservation Commission.)

The Uncertainty of Gold and Silver Production.—While there is every evidence that gold production will largely increase, few industries have, on the whole, less permanence in any given locality. It may be likened to a fever because of its sudden great activity, its decline and its intermittent revivals. The rumors of gold discovery start a "rush" of miners from all parts of the world. In the desire to stake out a good claim, it matters not if they must penetrate thick forest, hot desert or arctic waste. In 1849 men went from every land to California, in 1851 to Australia. In 1897, the news of gold on the Arctic Yukon in Alaska and the Klondyke caused the speedy departure, to that death-dealing land, of miners, professional men and even women,

struggled with their packs through the snowy passes of the ı Alaska mountains into a region of which they knew ing, to undertake a business of which many of them knew ing. This district also shows the quick rise and decline of ıd-mining district. The gold output of the Canadian Klon- was in

	Million dollars
1896	3
1897	2
1898	10
1899	16
1900	22
1903	12
1905	7
1907	3
1908	3.6
1909	3.9
1910	4.5

rise and decline was due to the fact that the deposits were in . and gravel along the streams where the individual worker d easily get the gold. The increase since 1907 marks the nning of the period of large scale production at the hands of ıwerful corporation which built 62 miles of flume and pipe to operate placers, and a water-power plant with 36 miles of ;ric transmission line. With this equipment, the Klondike have a few more years of prosperity and then another decline :h will be final unless the mother lode is found. The mother which will probably be found may last several decades before ıng reaches its ultimate depth, which is now about one mile has been reached in the Victoria gold mines. This district a scene of the great rush of 1851.

evada also has illustrated the uncertainty of the community ;nding upon the precious metals. In 1860 the state had 00 people dependent almost entirely for livelihood upon the ır from the mines in the great Comstock lode near Virginia '. The exhaustion of the mine caused the population to

fall to 40,000 in 1890, since no other mines of importance were discovered and agriculture was virtually impossible in an arid region. Since 1890 Nevada has been the scene of tremendous excitement because of the discovery of many new gold fields in the central and eastern part of the state. Many new towns have sprung up (population of state, 1910, 81,800), and single mills costing nearly a million dollars have been built to work the

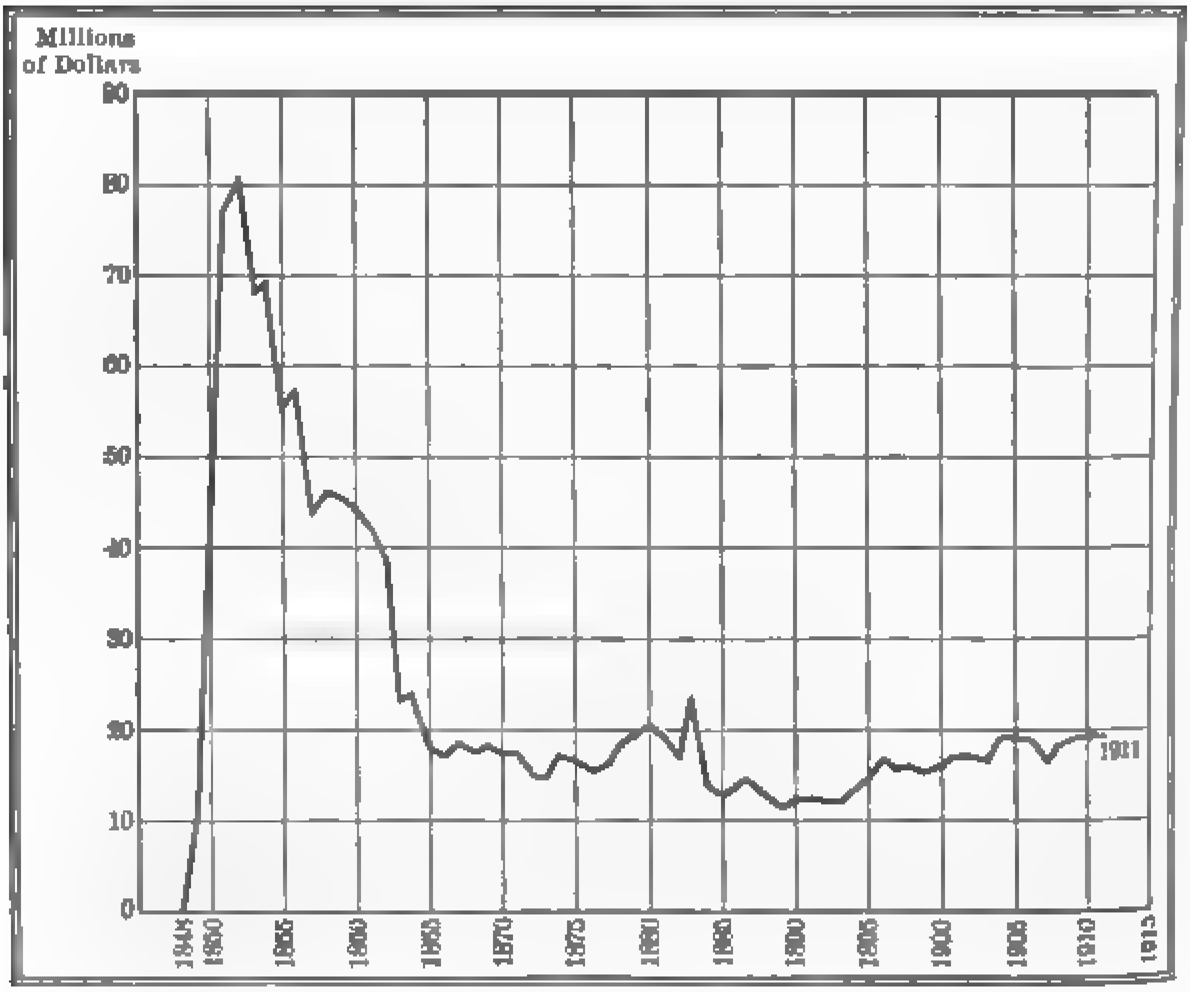


FIG. 199.—Gold production in California, 1848–1911. Compare this with previous gold production.

desert ores. One such mill takes 200 tons of gold-silver ore, concentrates it into one ton at a cost of $2.25 per ton and saves 97 to 99 per cent. of the metal.

California, long the leading gold producer in the Union, shows the uncertainties of the industry by its frequent changes of base. The gold discovered there in 1848 was in stream beds. These were soon exhausted, and the miners next discovered many old abandoned river beds and even buried river beds which could be reached by tunneling under lava deposits. Then came placer

deposits. Finally the mother lode was discovered and at present two-thirds of California gold is coming from deep mines in the hard ore and the state which had been surpassed by Colorado (vein mines) was again the leader in 1910.

Relation of Gold to Other Metals.—Aside from the gravel and placer deposits, few mines in the United States are worked for gold alone, because gold is generally closely associated with silver, copper, or lead. Thus most of the mining cities of the western mountain regions have several mineral products. This is particularly the case in Colorado, which in 1909 surpassed California in gold output, was third in silver and also produced copper and lead and zinc. Colorado cities, depending entirely upon mining, have arisen in almost inaccessible places in the Rocky Mountains, such as Cripple Creek, which produces about half of Colorado's present gold output, and Leadville, more than two miles above the sea.

Gold in Alaska.—Alaska, which in 1908 produced more gold than California, has three distinct fields. On the southeast coast (especially on Douglas Island) there are gold ores of low grade but of vast extent, which are being profitably worked in stamp mills. The profits have lately increased as a result of the operation of machinery by fuel oil from California. The total cost of working this ore was $1.60 per ton in 1910. The Yukon Valley, in which other centers of production will doubtless arise, has yielded gold first at the Klondyke in Canadian territory and later at Fairbanks and minor centers in United States territory. Cape Nome (beyond the Arctic circle) on the west coast of Alaska, has a most unusual deposit. It consists of a sea beach so enriched by gold-bearing streams that a miner could pan $10 worth of gold per day from the sands. More recently old beaches at higher levels have been discovered increasing the total output to several million dollars per year, and the Arctic desolation of beach and tundra is temporarily enlivened by a thriving settlement, living upon the produce brought by steamers from the south and landed in lighters on an unprotected beach during the good weather of summer.

Gold Mining in Africa.—The United States, with about $100,000,000 in gold per year, is second to the Transvaal, which in 1910 had an output of $155,000,000, while the adjacent colony

of Rhodesia yielded $1,000,000 a month. The producing district of the Transvaal known as the Rand is a long range of low hills, the leading gold district of the world with Johannesburg as its chief center. It is in a semi-arid country like New Mexico or Arizona, where other industries are few and communities of hundreds of thousands of people must live by mining alone. The deposits are of great depth, the companies

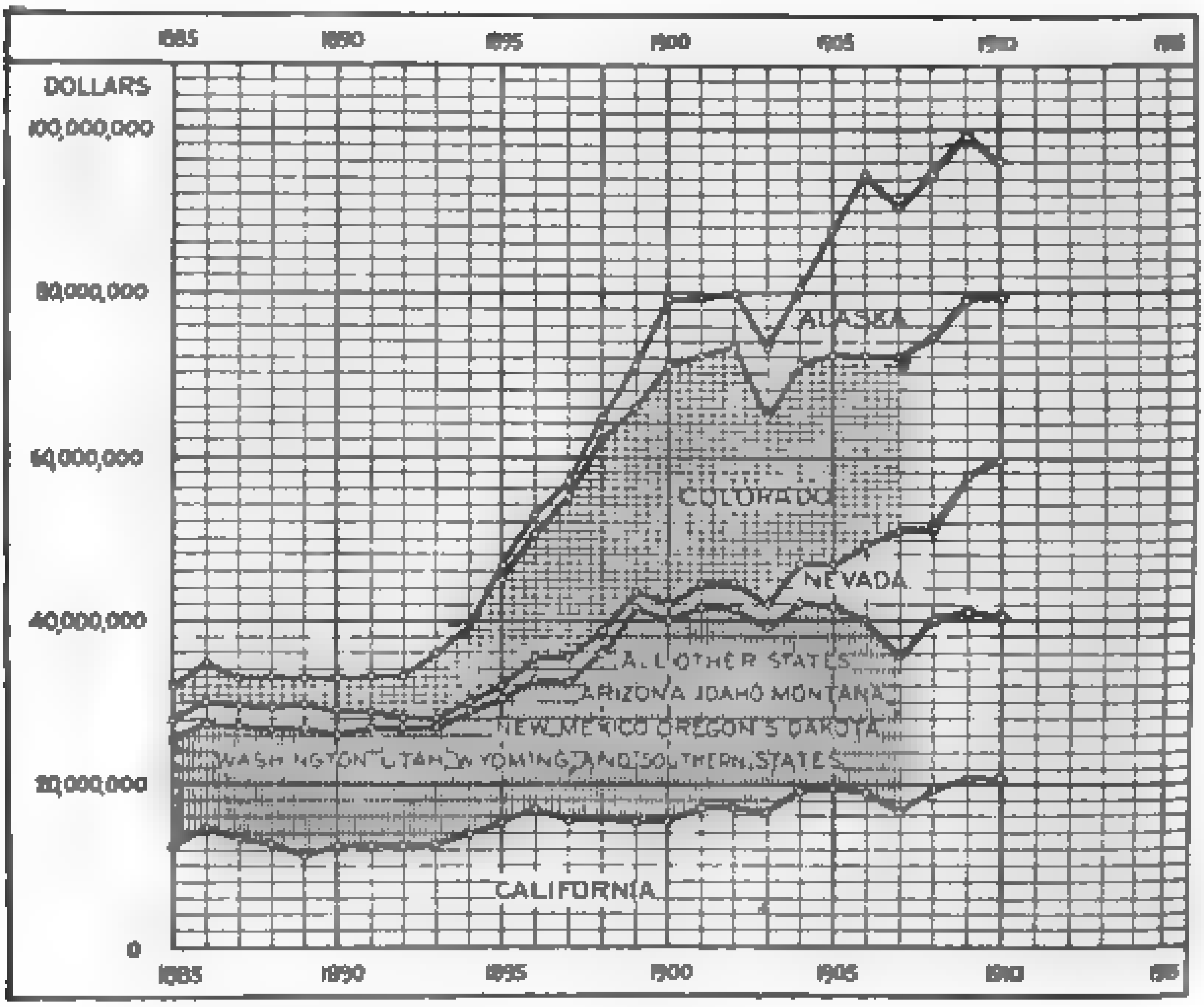


FIG. 200.—The production of gold in the United States and in the principal states. (U. S. Conservation Commission Report.)

can, therefore, plan to work for many years. The resultant great mining booms which occurred in 1895 and 1902 led to disappointment because of the scarcity of labor. This difficulty will be somewhat alleviated by the extension of railway lines into central Africa whence black workmen can be easily transported by rail. It is the practice to bring men from great distances to work in these mines on time contracts. In 1909, the total number of men employed on the Rand was about 220,000, and nearly 10,000 stamps were at work.

Some gold is being found in Madagascar, in the forest lands of West Africa, and recent finds in French Guinea on the upper Niger are reported to be of great promise.

Gold Mining in Australia.—Australia, with an output of $65,000,000 per year (1910), is third among the world's gold producers. The output of the newer west Australian fields, like that of the mines of Victoria, is declining, with the result that the total gold production for Australia fell off about $15, 000,000 between 1906 and 1910. It is expected, however, that the production of west Australia will continue at its present level, about half of the total, for a number of years, now that the surface deposits are collected and the working of the deep quartz has begun.

Other Gold Fields.—It is of interest to note that there is almost no gold produced in western Europe, Germany and Hungary together producing less than $5,000,000 annually. The Russian Empire with an output of about $25,000,000 is not far ahead of Mexico; and Mexican mines, under aggressive American management, are, unless stopped by physical disorder, likely to outstrip Russia with its inefficient labor supply, although Russian "resources are enormous," and there are vast unprospected areas in Russian Asia.

Gold and Silver in Spanish America.—The mountains of western America from the United States to Chile are rich in gold and silver, which have been alike a curse and a blessing to those regions. They urged on the conquest by the Spaniards and for many districts have been the chief basis of commerce since the discovery of America. The Spanish succeeded in getting gold by enslaving the people, one-half to work the mines, and the other half to produce food for the miners. In Peru and other parts of South America, the Spanish task masters mined large quantities of gold by placer mining in deposits of such low grade that they could only be worked now by our best efficient devices. Throughout the mountain districts only the best vein deposits could be worked and by the crudest hand methods, so that in many parts of the Andean region and in much of Mexico numerous deposits, although worked for many decades, may now be considered as new fields, in view of modern improvements in methods of mining, which, however, demand the railway for

their proper installation.[1] Despite the great production of Potosi in Bolivia, and other South American mines—"this enormous area (South America) almost equal as it is to North America, still lies undeveloped and awaiting investigation" (from page 519, *Fays' Mineral Industry*, 1907). Thus far the modern operations in South America have been limited to the temperate zone and to mountains where temperate climate prevails, as in the interior province of Antioquia in Colombia (output $3,000,000 in 1910), the east slope of Peru and the Bolivian and Peruvian plateau. There has also been a small output from the plateau of Brazil. The only thoroughly modern gold production in South America is $4,000,000 a year from the placer deposits in the European territories, the Guianas. Yet the resources of South America are such that even with the surface-scratching methods of the past, Colombia has yielded about a billion dollars in gold. One of the best ways to appreciate the advantages and possibilities of the present machine epoch is to remember that mining stops at the level of ground water unless power pumps remove it.

Gold in Central America and the West Indies.—Central America is reported to be rich in gold, but transportation and labor conditions are unsatisfactory and domestic capital is entirely lacking. Some American capital is now being invested there. The Island of Hayti has such disturbed political conditions that there is small chance of working the gold deposits, which are reported to be rich.

Silver.—Mexico is the leader in the world's silver production, has long been so and will likely continue to lead, unless she returns to her old political chaos. The resources appear to be enormous. In the past she has been preeminently a silver producer, partly because of the great number of silver deposits, and partly because these deposits can be mined in remote localities of a dry and rugged country where they are concentrated by the simple device of the arrastra—a stone floor on which ore is crushed by a stone wheel, rolled around upon the ore by beasts of burden. From the crushed ore the silver collects in the cracks of the floor and in this concentrated form is carried scores or even hundreds of miles on pack mules. The

[1] In this connection the railway map of South America should be examined.

building of American railways into Mexico has made possible the opening up of mines using most improved machinery and processes, and has caused rapid increase in the output of gold, bringing the production of silver (usually associated with gold) up to a point where the declining price serves as a check to its production—a situation unique among important commercial products in an era of rising prices. There is also a rapidly increasing copper output, and, with a total mineral product of $150,000,000 per year, Mexico probably depends more for prosperity on minerals than any other country, except Chile.

In the United States, second to Mexico in output, silver mining depends for its prosperity upon the output of gold, copper, and lead. The mines operated for silver alone are

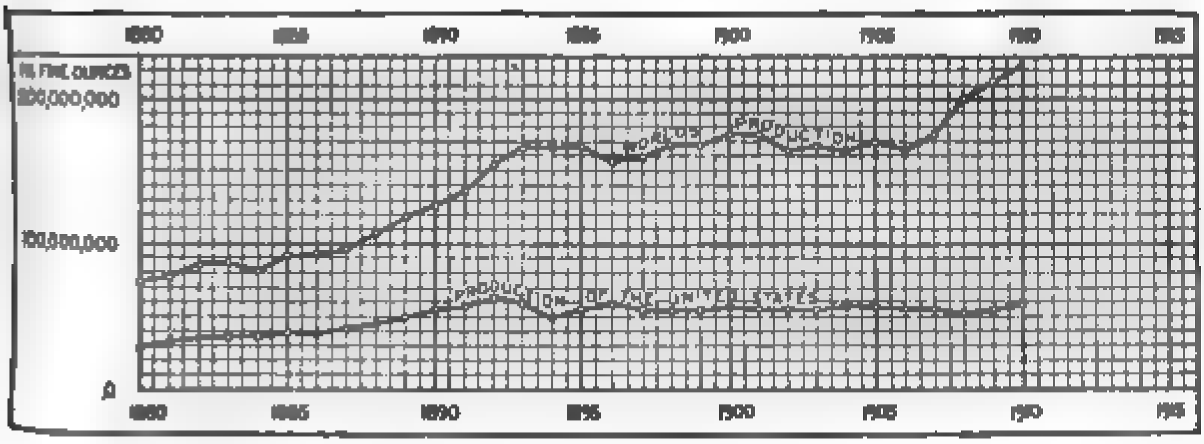


FIG. 201.—Silver production is unusual in that it does not increase.

relatively few. The total output of silver in the United States, $30,000,000 in 1910, is but a third of the value of the $94,000,000 corn crop of Indiana (fourth in corn, 1911).

Canada, the third silver producer, gets nearly all of her $17,000,000 worth (1910) from the very rich new silver districts of Cobalt and Porcupine in the forests of upper Ontario. Australia is fourth and Germany, the chief producer of the western world in the middle ages, is fifth with $6,000,000. The other European producers are Belgium with an output of $4,000,000 won from the hills in the eastern part of that country and France with only $1,000,000 worth.

The Future of Gold and Silver Production.—Few industries have had so great a reduction in the cost of operation as has taken place in the production of gold and silver, especially of gold. Therefore, few materials of use to man have greater

prospects of rapid increase in output. Much the greater part of the world has not been prospected adequately and deposits already known will provide for a largely increased output in the next few decades. This increase in production may take place too rapidly for the welfare of the world, owing to the disturbing influence that large production is supposed to have upon prices, probably the most interesting aspect of gold production.

5. DIAMONDS

Source of Our Present Supply.—Brazil was for a long time the leading diamond-producing country in the world. They were found upon the interior plateaus of the state of Minas Geraes, near Diamantina, in a sparsely settled region where the diamonds had been left in the beds of streams by the same process which leaves gold in the stream, namely, the washing down of the mother lode. During the last quarter of the nineteenth century, South Africa vastly outdistanced Brazil, because of the discovery of several so-called diamond pipes in the vicinity of Kimberly, in the Transvaal. These deposits are believed to be the cores of old volcanoes with diamonds imbedded in the lava, now existing as a hard formation known as blue clay or diamond clay. The washing of the clay from these old volcanic necks produced diamonds so much more cheaply than the hunters of Brazil can find them that for many years South Africa has virtually supplied the world. Nearly all the product is furnished by two companies. One of these, the Premier Diamond Company, simply lifts the earth from the bottom of enormous open pits, crushes and washes it in a way not unlike that in which the gold-bearing ore is washed after crushing. Owing to the difficulty of preventing the native Kaffirs from stealing and carrying the diamonds out of the mines, men are kept on the premises almost like prisoners during the time of their labor contracts. The price of diamonds rose from 1900 to 1912, but it does not indicate any scarcity of the stones. It resulted from the control of the market by the diamond syndicate, which shut down the mines in 1908 when the demand fell off as a result of the financial depression of 1907–08. The trade in diamonds seems to be peculiarly sensitive to the checking influence of financial depression.

New Diamond Fields.—There is prospect that the long diamond

ıonopoly of British South Africa will shortly disappear. Further ĸplorations in Africa have revealed new finds of true diamond-earing earth in Rhodesia, while in German Southwest Africa, iamonds are secured in the sand on or near the seashore for 00 miles north of Elizabeth Bay. Miners wash the sand for iamonds the same way the gold miners wash the Cape Nome and for gold. Unfortunately for the easy prosecution of the ıdustry, this region is a desert, less so than that of similar ıtitudes in northern Chile, but supplies must be brought hun-reds of miles. Recent explorations seem to indicate the discovery f the volcanic neck from which these shore diamonds have been 'ashed. Thus German Africa has had developments similar › the Transvaal, where there was for a time a large diamond ıdustry on the shores of the Vaal River where the searching for 'ater-borne stones finally led to the discovery of the mother lode ı the blue clay. The German government itself is now actively ngaged in diamond mining and the product of German South-'est Africa amounted to $5,000,000 in 1910.

The finding of river diamonds in Katanga, west of Lake 'anganyiha, 1,500 miles north of Kimberley, in German East Africa, opposite Madagascar, in Guiana, New South Wales, 'alifornia, and elsewhere, is indicative of abundant supplies. merican companies are trying to modernize the old workings f Brazil, while geologists have reported a true volcanic neck with iamonds embedded in it near Murphreesboro, Arkansas. The rice of diamonds would long ago have been greatly reduced but ɔr the price control of the Trust.

The United States is the greatest diamond market in the world rith purchases of $40,000,000 per year in 1911, but the cutting f the diamonds is chiefly done in Europe. Amsterdam has long een the great center of this skilled trade, but the recent increase ı diamond output has gone largely to Antwerp and the German upply is now chiefly cut in Hanau. Altogether diamond cutting mploys over 100,000 persons.

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CHAPTER XVII

THE EXPANSION OF INDUSTRY AND OF RESOURCES

1. THE BALANCE BETWEEN RESOURCES AND HUMAN NEED

Definition of Resources.—A resource is something which may be turned into, or made to produce, a useful commodity, and thus give rise to an object of consumption or of commerce, and aid in the support of population.

There is frequent expression of the idea that opportunities for the making of a living are getting fewer, that the world holds less opportunities per man than it previously possessed. This belief is not founded in geographic or scientific fact. If it appears true, it is due to the shortcomings of our financial and industrial system, and from our hotch potch and purely irrational method of distributing wealth and holding property. There is good reason for the belief that the available resources of the world are increasing quite as rapidly as the population and that they will continue to do so for a long time to come.

The complaint about the lack of opportunity is old. At various times in the world's history industry has apparently caught up with the available resources, so that there actually were few opportunities available. Such a period was the warlike and piratical seventeenth century. As commerce and the desirable and available world then existed, there seemed to be little room for enterprise for the daring, or investments for the capitalist. Foreign people were positively or potentially hostile and, therefore, their lands were unsafe. The sea was unsafe for merchantmen, railroads were absent, highways were bad and while lands lay idle they could not be reached by industry. The people of Holland, then the greatest financial country and the chief money lender in the world, found themselves in a land of small opportunity, as a result of the great scarcity of resources to develop. There were few new enterprises in which they could invest their

urpluses, hence interest rates sank to a very low point. At he present time, on the other hand, the railroad and steamship nd the security of peace have made almost the whole world vailable to commerce, to investment, and to settlement by ivilized people. The rapid progress of science, showing us new ays to utilize resources, has brought the world into a period f really rapidly increasing resources (opportunities for industry). hese resources need developing and offer employment to the apital and labor of all nations.

The Dutch investor in this period owns railroads in the United tates, plantations in Java, nitrate works in Chile, and the rate f income is several times as great as it was in the seventeenth entury.

The Degree of Utilization of Resources.—The question naturlly arises, when are resources fully utilized, and when is a country ully occupied. It is difficult to say when a country is full ecause of the present practice of living by manufacturing and onsuming the products of other localities. The question of the tandard of living is a second factor making it difficult to deterine when resources are fully utilized. If the population is ontent to live in small houses rather than large, to eat grains, egetables, and beans rather than meat and other things requiring ore land to produce, then the population can be large. Under he system of household industry many localities of Europe and sia have become populated up to the food limit, the non-flesh od limit, and the record of famines in India shows that country o be far beyond the food limit in years of crop failure. Millions here have starved beside the railway, which could have brought hem food if they had had goods or money with which to buy it. elgium, the most densely peopled of Western lands, has passed he point where she can under present standards feed her people; ut she has passed into the stage of buying raw material and sellg manufactures and importing food with the proceeds. This ation, like other nations, and other localities in Europe and merica, has become like a city in its economic life and is steadily creasing in population, and, with the steady increase of comercial facilities, shows evidence of continuing growth in anufacture, population, and dependence upon the foreign arkets and upon foreign raw materials. To a large number of

people in Belgium, their land is a home space, in part at least, their sustenance space being in other lands.[1]

The best example of a country approaching the full develop-

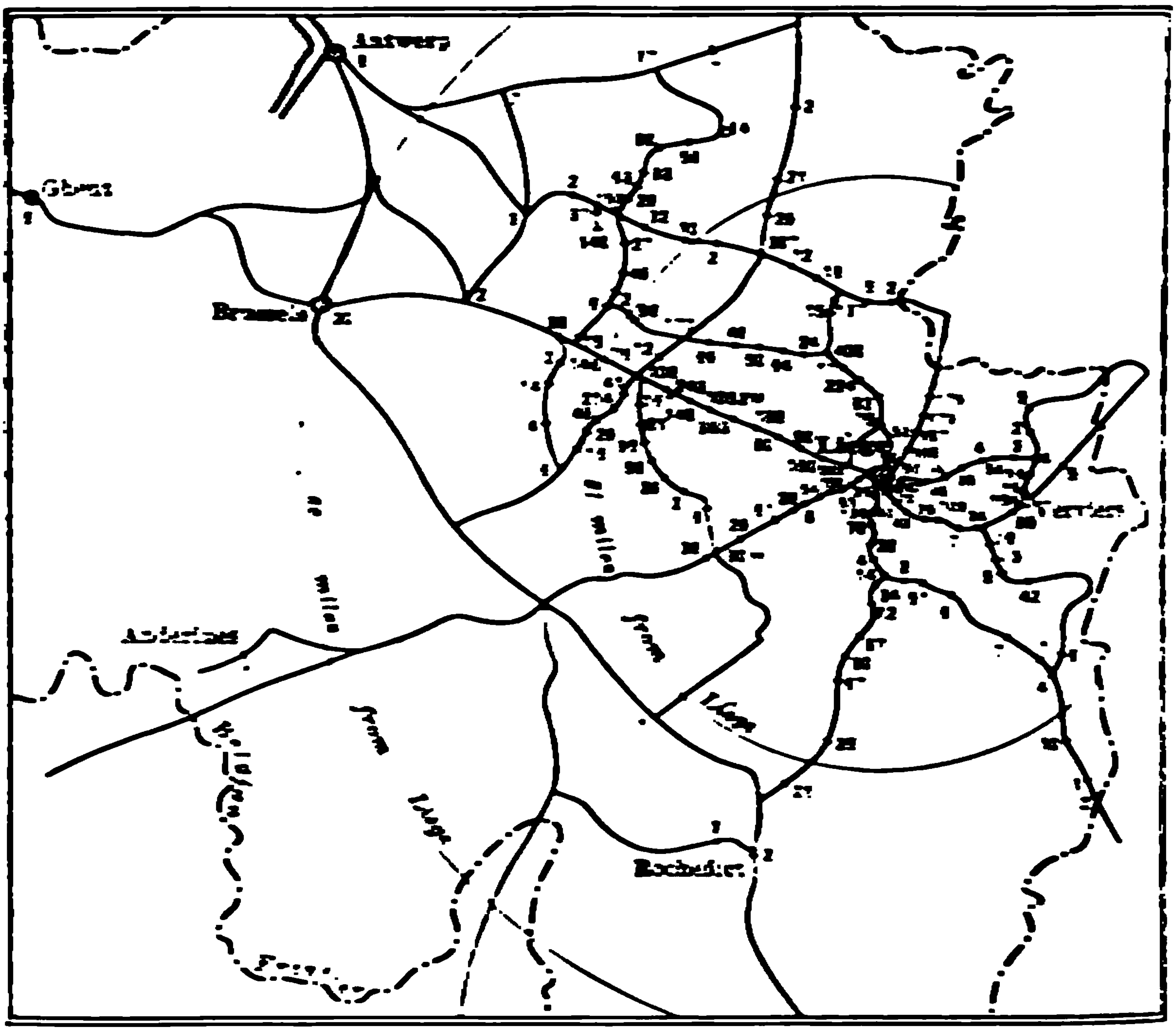

FIG. 212.—Distribution of city workers of Liege, to village homes. Figures represent number going from each station to Liege, June 1-15, 1906. Small agriculture is added to factory wages. By trades: miners, 1832, factory men 2871, building trades 1440, unskilled 1483, dress-makers and milliners 360, apprentices 242, other trades 1167, railway workmen 530, total 9925, of whom 5830 went daily and 4095 weekly. (From Land and Labor by B. S. Rowntree.)

ment of its resources is Japan, with meager mineral wealth, rugged topography, a small proportion of arable land, and a popu-

[1] Belgium is ahead of any other western nation in the scientific utilization of her resources. Her factory workers live upon the land to a degree unknown elsewhere. With his plot of ground there is room for production by the aid of women and children, old persons, and the spare time of the artisan himself. This garden produce, the poultry, hares, and possibly the cows are great additions to a low wage and they conduce to the intensity of culture that gives large return per unit of land. See "Results of Agriculture Extension in Belgium," Annual Report of Office of Experiment Stations, 19[illegible], U. S. Department of Agriculture; "Land and Labor in Belgium," an exhaustive and informing work by B. S. Rowntree.

lation of 2,200 per square mile of tilled land, nearly four persons per acre. Until the recent sudden shift to commerce, this population supported itself almost entirely by agriculture, with an average area of 2.6 acres per farm family. Upon this slim resource, the nation had maintained its physical and intellectual vigor and a high civilization; but to do so they have entered almost exclusively upon the ultimate stage of agriculture, namely, the garden stage of hand labor and the non-flesh diet.

In 1907 Japan reclaimed 64,448 acres of land, an area large enough to feed over 200,000 people and new lands to be reclaimed will provide for over 30 million increase of population at the present rates of 3.4 people per acre.

The mystery of the way in which China supports her millions is explained by a skilled American agricultural observer's account of a visit to the farms of the densely peopled province of Shantung.[1] Every scrap of vegetable matter and excrement is saved and returned to the fields which yield a harvest of wheat or barley in June and then, with the aid of midsummer monsoon rains, a second crop of millet, corn, sweet potatoes, peanuts or soy beans. The last two are nitrogenous meat substitutes and help explain the observer's statement that "One of the farmers in this province with whom we talked had a family of twelve people which he was maintaining on 2.5 acres of good farm land, keeping besides one milk cow (also used as a work animal), one donkey, and two pigs. The crops raised were wheat or barley, millet, soy beans, and sweet potatoes." This is at the astonishing rate of 3,072 persons per square mile and also on the same square mile 256 cows, 256 donkeys, and 512 pigs. It would be an impossible search to find an American square mile that could feed, under American methods, the animals alone. Japan, and apparently China are now entering upon the second stage of development, in which there will be (as now in Europe) a large manufacturing population added to this agricultural population.

In the light of these achievements and tendencies of the yellow race it is plain that even they have by no means caught up with the resources at their disposal. Japan, average population 336 per square mile, is probably the nearest approach to it, and in Europe, Italy, average 312 per square mile, is probably

[1] *Farmers of Forty Centuries*, F. H. King.

and we have an advantage unique in the western world—the great gift of corn for which we have a vast area. Over 1 million square miles of the United States can produce this king of forage crops, the most productive and easily grown of all the grains. Further, this grain lends itself to double cropping, the recourse of the crowded people. In Japan and China, and wherever possible in Italy, the land is made to yield two crops per year, winter grain between October and June, and rice or other summer crop between June and September. Similar double cropping, now almost unknown in the United States, can be done, if need be, in most of the United States corn belt. For example, as far north as New Jersey a good crop of peas can be harvested in May and June, and young corn, sown between the rows, will ripen a full crop before frost. Even a third crop can be grown and agriculture yet maintain its western standard. Cowpeas, clover, and several other leguminous plants will thrive with the corn or cotton, enriching the soil with their roots, feeding animals with their tops and making possible a wealth of agricultural production now undreamed of in most of the United States and impossible in sunny Italy, with its rainless summer. Yet even there over 300 people per square mile succeed in extracting a living from the earth. The American cotton belt, with its summer rain, now supporting only from twenty to fifty people per square mile and six times the size of Italy, has easily twice the abilities of Italy in the production of food, raiment, and timber and is many fold richer in minerals and waterpower.

We have in the United States 100,000 square miles of swamp lands, scattered among the old glacial lake beds in the northeast, in tidal marshes along the Atlantic coast, in cane brakes south of the Chesapeake and in the alluvial lands along the Mississippi and other rivers. These swamps when drained are twice as productive as uplands, and are at the present time almost untouched. Moreover, we have in the West 60,000 square miles which irrigation can make almost or quite as productive as the reclaimed marshes.

Canada, with a population about equal to that of Belgium, has in the east a large area relatively as unused as is the United States and the vast plains west of Winnipeg contain several hundred million acres of fertile lands which would support scores,

if not hundreds of millions of people if tilled like similar plains in Germany, Sweden, or north Japan.

Alaska, to the surprise of all Americans, has been found capable of producing luxuriant grasses and ripened grain, and if need be, it can easily be made another Finland, which supports several million agriculturists with millions of farm animals and exports a vast amount of lumber.

The Trans-Siberian Railway has opened up the heart of a country larger than Europe, which possesses a wide belt of at present unused grain lands, almost another Canada, which may possibly permit the Russian Empire to double her population with ease. Manchuria and Korea, for which Japan and Russia fought, have unused lands several times greater in area than those which support the fifty million Japanese, but it is probably true that these lands are not so productive as those of Japan because of the high percentage of irrigation in Japan. China, with a population which taxes the food-producing resources of her empire, has a huge labor supply, untouched mineral resources second only to those of the United States, with the result that the manufacturing possibilities there are much more stupendous than they are in the United States.

In Western Asia the era of railroad building is just begun in what was once the seat of empires and kingdoms—Asia Minor, Syria, Mesopotamia and Persia. The richest part of Asia west of India is Mesopotamia, the Valley of the Tigris and Euphrates Rivers, where the irrigated soil supported dense populations of farmers and townsmen from before the days of Abraham until after the fall of Rome. Now, cursed by Turkish misrule, it lies unused with abandoned irrigation ditches reaching through several million acres of alluvial soil. But there is every prospect that, under the development of European engineers and capitalists, whose attention and railroads are now directed toward it, it may again become the seat of great agricultural production and a large population.

In Argentina and Uruguay in South America, in South Africa, in Australia and in New Zealand, the south temperate zone has millions of square miles of land, with a total population less than that of Holland and Belgium. These large territories, while greatly limited by aridity, have a wholesome, invigorating

climate, and resources that will permit a many-fold increase in the population based on a many-fold increase in the production of grain, meat, dairy products, and fruits. Moreover, like most of the world, their mineral resources are but slightly prospected.

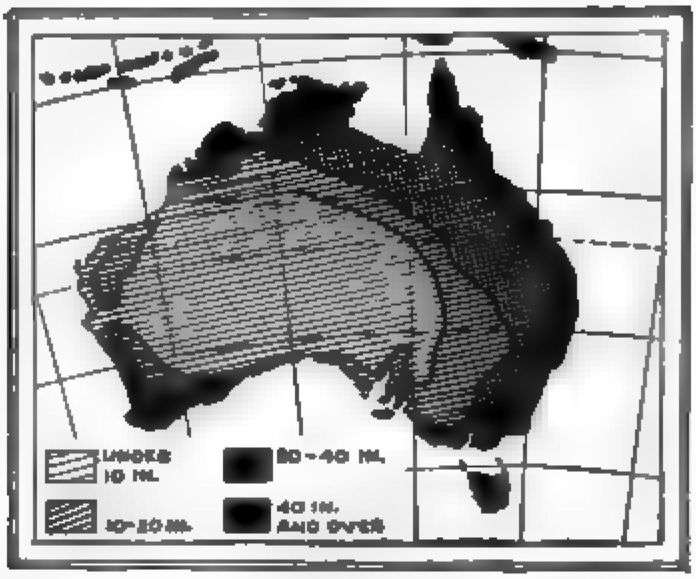

FIG. 204a.

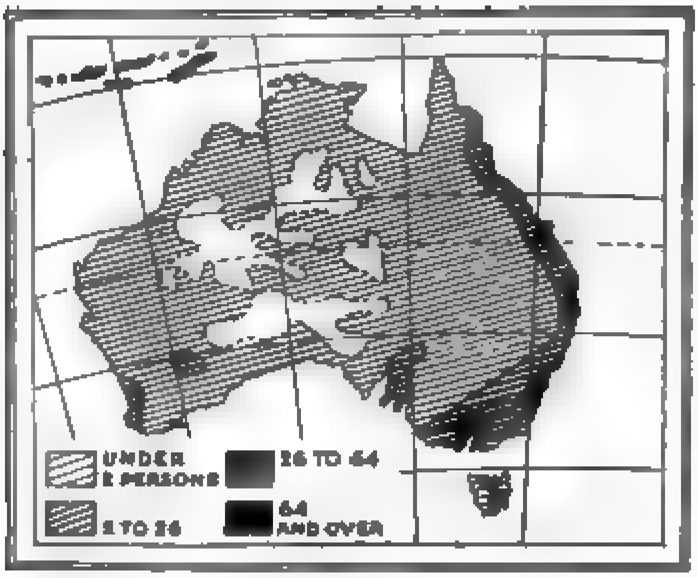

FIG. 204b.

FIG. 204a.—Mean annual rainfall for Australia. (Diercke.) b. Map showing density of population per square mile in Australia. (Lyde.) (From W. S Tower.) Australia is a relatively empty shell.

The Desire for Immigrants.—With the knowledge of numerous unused resources of the temperate zones, we are in a position to understand the great efforts that have been made by many countries with unoccupied and undeveloped lands to induce immigration from the densely populated countries. For decades the United States gave away 160 acres of land to any man of any

color or nation who would come and live upon it. At the present time many American states, especially those in the west and south, but also in the northeast, are making an organized and persistent effort to spread knowledge of their unused lands and attract settlers. Canada is to-day expensively advertising in many countries the fact that she, too, has good farms to give away to all settlers. Australia, Chile and the Argentine Republic have actually loaned immigrants money and assisted in their transportation to the lands which were to be their new homes.

3. SCIENCE CREATES RESOURCES

In the face of all these resources, usable under present knowledge, but unused, comes the great growth of Science. She is yet young and fecund. Our new knowledge, applicable alike to agriculture, manufacture, mining and transport gives us many new facilities for utilizing things before unavailable. It, therefore, may be said to create resources of great aid to every land from empty Australia to the teeming Orient, still depending upon human muscle for bearing burdens and running the loom.

One of these great resource creators is chemistry, one of the most mysterious of all sciences to the laymen. It certainly is one of the most important for the increase of man's economic possibilities, and doubtless great economic gains are yet to come from the laboratory. Suggestive of progress from this source is the synthetic method of making indigo, which is now almost entirely produced from retorts of coal tar rather than the vats in which the people of India and Central America fermented the stalks of the indigo plant. The indigo fields are now free to produce food.

It, therefore, appears that in the twentieth century the human race looks out upon a new world—a newer world in the economic sense than the one Columbus showed to the sixteenth century—the world created by scientific industry and speedy transportation. Old standards for the measurement of the value of lands to man are gone and the new scientific utilizations are changing by a series of improvements more rapid than we have ever before experienced and the end is not in sight.

New Resources for Manufacture.—Aside from the production

of food, the most important single resource for the maintenance of existing civilization is that which will give power to drive machinery. At the present time we are depending largely upon coal, which, being a mineral, is one of our surely perishable resources. Unlike the field which may yield thousands of crops, or the forests which may perpetually yield timber or the waterfall which will run on for ages, coal, once used, is gone forever. This most important mineral has recently had its economic value doubled by the discovery of the art of making producer gas, which utilizes inferior coal or peat itself, for the making of gas for the running of gas engines—much the most efficient means of producing power from fuel.

The new turbine water wheel and the rapidly developing art of transmission of power by electricity are introducing a water-power era. The full utilization of power, which now flows uselessly to the sea, might enable many now sparsely peopled parts of the world to maintain large manufacturing populations.

If water-power should become inadequate there are many parts of the world in which the wind blows with great force and regularity. This has long been used as a source of industrial power in Holland, and modern windmills, if we choose to use them, are much more efficient than the picturesque Dutch pattern. It has already been pointed out that the direct rays of the sun, the original source of all power, all coal, all streams, and most of the wind, is, through its rays, showering upon the earth's surface unlimited energy, which we may shortly find to be the most easily obtained of all sources of power.

Science Increases Mineral Resources.—The application of science to the art of mining and purifying minerals and metals has produced changes quite as great as in other fields. Its effect in developing industry and supporting populations is well illustrated in the cement industry. Rough limestone farms, whose projecting rocks have made it difficult for a family to make a living, suddenly become the quarries where for decades scores of men blast limestone for the neighboring cement mill. The cyanide process of extracting metals from ore has vastly increased the amount of gold and other metals which it is possible for mankind to obtain from the earth's crust. Similar improvements have been made in almost all branches of mining. As it is now

ssible to work deposits at least a mile in depth, and of the 50 llion square miles of the earth's surface we have prospected oroughly less than 1 per cent, it is evident that we have arcely touched the world's mineral resources. The discovery of portant new iron-ore deposits in old England within the last e years shows the lack of thoroughness in our past search r metal.

New Resources in Agriculture.—Agriculture is the mother of dustries. By the creation of new resources in agriculture ience can give to man his greatest aids to increased support on the earth. Food is man's limiting factor. He absolutely quires a certain amount of it and the increase of the food supply the thing that will permit man's numbers to add billion on llion in the peopling of the earth. Thus agriculture outranks l other industries in importance.

In the utilization of the earth for agriculture, we have, down to e latter part of the nineteenth century, used a haphazard ethod. With regard to the twentieth century possibilities, e have often been like the Indian, who in a field of buffaloes lled a hundred and carried off only their tongues. Science is w beginning to examine all parts of the earth with regard to usefulness, as the by-product savers of a modern slaughter-use examine and use every part of an ox.

The essential thing about the earth from the agricultural andpoint is its fertility. How to unlock it is man's problem. e key for this unlocking is vegetation and vegetation must ve as aids, first heat, second light, and third moisture. There-re, in the past it has been the warm moist places that have oduced man's food, and in addition agriculture has thus far ne but little where the land could not be plowed. The past istance on this fourth factor (arability) has caused vast ssibilities of fertility, heat, and moisture to be practically used, and vast soil resources to be barbarously wasted and de-oyed to the permanent and profound injury of the earth as a me for man. The barriers that have held men especially in e temperate zones from utilizing fertility have been, first cold, ond aridity, third steep and rocky surface, fourth excess of isture, and fifth unwholesome climate.

Down to the end of the nineteenth century, man's progress in

the increase of powers and the combat of difficulties, was essentially the result of the unscientific effort of untrained workers and the enthusiasm of the individuals who tamed the wild animals of the forest, cultivated and improved by selection those plants that seemed most useful, and, by accident, made inventions and discoveries. We have now entered upon a new epoch.

1. Thousands of men are now being definitely trained by the most careful study of those sciences which are fundamental to existing knowledge and future discoveries, in all the fields of human endeavor.

2. It is of equal importance that institutions are supporting these men in their constructive work. Edison and Burbank were compelled to raise money to support their profoundly important work, an example of unappreciation and waste of valuable energy which, let us hope, humanity will not long permit.

We have recently discovered the laws of heredity and the art of breeding and therefore of improving the plants which furnish us most of our food, clothing, and raw materials. These plants become machines, man the mechanic. We understand the effects of environments in fitting plants to survive particular conditions. If the climate of Arizona is dry, we now know that each and every desert in the world has been developing plants to thrive in Arizona. For example, the date is an Old World adaptation of nature to the dry environment. Knowing this, we no longer depend upon chance introduction of plants by emigrants and plant-loving botanists. The search has become definite and organized. Governments and corporations are searching the world in an organized way that each section may secure crops best fitted for it, by getting and improving the plants from similar places throughout the world. Thus a new alfalfa from Siberia, or a peach from Mongolia is hardy by the natural selection resulting from 10,000 or 10,000,000 raging winters. It is raw material for the plant breeder of the Agricultural Experiment Station. By this work of the plant explorer and the plant breeder, we can get the new cold-resistant or quick-growing plant that pushes the farm line north or the new drought-resistant plant that pushes the farm line into the arid, or the better yielding plant for the fields now under cultivation. The sugar beet has had its sugar content increased several fold within a century—suggestive of

changes for the better, that may come to any plant and are now actually in process for many.[1] By the combination of the searching of the world's cold and arid deserts and the improvement of plants there found, new crops are already being produced and harvested in lands previously too arid or too cold for any use but scanty pasturages. One of these quick-growing plants is the kaffir corn, now largely grown near the 100th meridian in the United States, where for every mile it pushes the farm line westward, opens to cultivation 1,600 square miles of farms, which will, under existing American conditions, easily support 75,000 people, and in some countries of the world would support several times that number. The thornless cactus holds the possibility of good pasturages in what is now the dead desert.

The Domestication of New Plants.—Vast additions to wealth, comfort, and industry are to come from the domestication of plants now unused or only produced by unaided nature. A suggestive example of this policy and its revolutionary results is shown in the history of the cinchona industry. The bark of this tree produces quinine, so prized as a remedy for certain fevers and malaria that the British government compels it to be kept on sale in small packages in every post-office in India. For more than two centuries after its discovery, in 1638, cinchona bark was produced only on the remote eastern slopes of the Andean Mountains in Peru, Bolivia, Ecuador, and Colombia. It was gathered from trees growing wild in the forest, and no one thought of questioning that this mountain range had a permanent world monopoly of this precious product, until, in 1852 the Dutch government introduced it into Java, and in 1860, Clements Markham, an Englishman, introduced it into India. It is now cultivated on the southern slopes of the Himalayas and on the mountains of southern India. It was, however, most extensively cultivated on a commercial scale in Ceylon with such success that between 1881 and 1886 the export to London increased from 350 tons to over 5,000 tons. The Ceylon supply was so much larger than the South American that it became unprofitable even to the Ceylonese, and the industry has

[1] Surprising results have been obtained in getting strains of corn to be (*a*) more vigorous and productive, (*b*) more oily, (*c*) more starchy, (*d*) more highly charged with protein than before.

declined in that country from 64,000 acres in 1883 to 9 acres in 1912, but it has steadily increased in Java, with its populous valleys and humid mountain slopes until the export from its cinchona groves reached over 10,000 tons in 1911. The price is one-thirtieth that which prevailed in 1870 when it was gathered wild upon the Andean slopes. The export from South America has practically ceased, for the hunter in the sparsely peopled forests is unable to compete with the myriad villagers and the systematic plantations of Java.

Rubber and Cinchona Compared.—The progress of the cinchona industry exceedingly resembles the rubber industry in many respects. To-day the world's chief supply of rubber comes from the South American forests in the same region that, upon its western edge, produces the cinchona. The rubber tree grows up to about 3,000 feet elevation, which is the altitude at which the high-land loving cinchona begins. Rubber, with a much wider range of climate than cinchona, is now being cultivated by many peoples, among them the Ceylonese and Javanese, who began the cultivation of cinchona. There is good prospect that the rubber plantation will be as superior to forest hunting as is the cinchona plantation to the gathering of the wild bark. If so, great trade readjustments and increase of wealth must result. Every decade of the twentieth century should witness one or more (probably several) such important transfers of supply of an important product from the forest to the field or orchard, from the hunter to the cultivator, with great increase of supply and reduction in cost. A very interesting example of the process is the recent discovery that the hevea rubber tree of the Malayan plantations is a heavy producer of seed, containing forty-two per cent. oil closely resembling linseed oil.

Animal Breeding.—Another great field where science affects agriculture is the breeding of animals. This follows the same laws as plant breeding and has been understood longer. The work already done in this direction is easily appreciated by comparing the useful cow with the wild buffalo. By the application of known science to animal breeding, the efficiency of our domestic animals along many lines can be approximately doubled with little increase in the amount of man's effort in their behalf. For example, Mr. John R. Valentine states that in Ayrshire,

Scotland, the average amount of milk produced is 6,600 pounds per cow per year. In Pennsylvania it is 3,900, the difference being attributed to the prevalence of cow testing in Ayrshire and its absence in Pennsylvania, which has such superior natural advantages for dairying.

4. NEW RESOURCES THROUGH TREE CROPS

Possibly the greatest of all agricultural benefits will come through the breeding of new crop-yielding trees—a piece of slow scientific work for which we are now ready.

Man began agriculture at the wrong end of the plant kingdom. The grains upon which we feed are all weaklings. Harvest is often but a small handful in comparison to yields of tree crops—the engines of nature which have for ages been giving man the most astonishing object lessons of production, and inviting him to improve them rather than the feeble grains at their feet, but the grains are annuals—a profound advantage to primitive man.

Great Productivity and Profit of Tree Crops.—According to a recent report[1] the chestnut orchards of Italy yielded *per acre* nuts in amount approximately equal to the per-acre yield of wheat fields in the United States. The wheat grows on the best and levelest and most easily tillable soil of America, while the chestnut orchards of Italy occupy the steep, rocky, untillable mountain sides. While the wheat lands must be plowed for each crop, the chestnut orchards have not been plowed in ten thousand years. The trees stand among the rocks and at their feet are pasturage and herds to match the laborious plowing and seed time of wheat culture. This tree crop is the bread supply and the money crop of many thousands of mountain dwellers in the higher regions of Mediterranean countries. The value of these orchards is most evident. In crossing the Apennines from Bologna to Florence, the first 2,000 feet of the climb upward from the level plain of the Po is through an unproductive and almost unpopulated district. At 2,000 feet the forest line begins, groves of grafted chestnut trees cover the rugged hills for many miles, and numerous villages show that these groves

[1] Deecke, Italy.

support a large population. The sale value of these chestnut orchards exceeds that of American wheat land.

The uses of land run through grades of intensity in utilization and value of output somewhat as follows: First, the forest with its game, furs, and gums; second, the forest with its lumber; third, pasturage; fourth, tillage and grain; fifth, tree crops.

FIG. 205.—Tree crop agriculture. Grafted chestnut trees on granitic hillside in the Department of Ardeche, 70 miles southwest of Lyons, France. Value $160 per acre, producing nuts, pasture for goats and cows, and bedding of leaves and Scotch broom.

Whenever we find agriculture going over from the annual grains to the perennial tree crops, we find an agriculture of increased output rivaled only by the market garden. Wheat, corn, and oats yield but poorly in comparison to the heavy harvest and large income furnished by the apple, peach, orange, date, olive, or Persian (so-called English) walnut. Despite this productivity of trees, we have until the present depended almost purely upon

hance. Freak trees have arisen by accidental hybridizing here nd there to become the parents of a variety.

Now, however, science has caught up. We need no longer epend upon chance, the well-tried method of the ancient nomad. 'e have the laws of plant breeding, and as a result tree crops, e agriculture of great yield, are to come out of the corners here they now occupy so inconspicuous a place. It is probable at the cultivated fruiting trees of all sorts do not cover over 2 r cent. as much ground as is given over to the less productive ains. As agriculture adjusts itself suitably to resource, the ea of tree crops with their great superiorities will eventually outstrip the grain crops.

Plant breeding, scientific (not accidental) plant breeding, is orce that will transform agriculture as the steam engine has ansformed transport and the factory. It will enable us to rness the trees, the great productive engines of the plant ngdom. The plant breeder, the constructive botanist, now ls us, for example, that it is only a matter of time and patience make, by repeated crosses, a good crop-yielding hickory tree, nost an ideal hickory tree. It can have the delicious sweet vor of the shellbark, the thin shell of the Kentucky nut, and ough of the size of the Indiana giant to put it in the English lnut class so far as food value, accessibility, and desirability concerned, but with this great difference from the standpoint production. It is thoroughly acclimated by thousands of ars' adjustment to our changeable climate, and the English lnut is a Mediterranean exotic, at home in the United States ly on the Pacific coast where Mediterranean conditions prevail.

For two centuries the white man has been felling the forests America to make fields. Many an eastern field, now of low tility and scanty harvest, has, or has had, upon it the acorn-aring oak, the nut-bearing walnut, chestnut, and hickory (or ellbark), the seedling apple, the seedling peach, the red-heart d black-heart cherry (wild mazzard) and the fruitful persimmon d pawpaw. Yet this year, as for generations, all these astound-g possibilities of crops have been negligently brushed aside, t down, rolled in piles, burned up to make room for wheat and n.

Science, backed by money and patience, promises some good

tree crop for a million square miles of American hills. But science is as yet doing little to bestow this unthinkable gift upon us, because the work depends upon appropriations by far-seeing legislators.

For New England, as other rough and reasonably humid countries, the significance of the mulberry as of the walnut, hickory, and acorn-bearing oak and many other crop-yielding trees is this—these trees, these engines of production, do not depend upon the plow. They laugh at rocks. They can wedge their

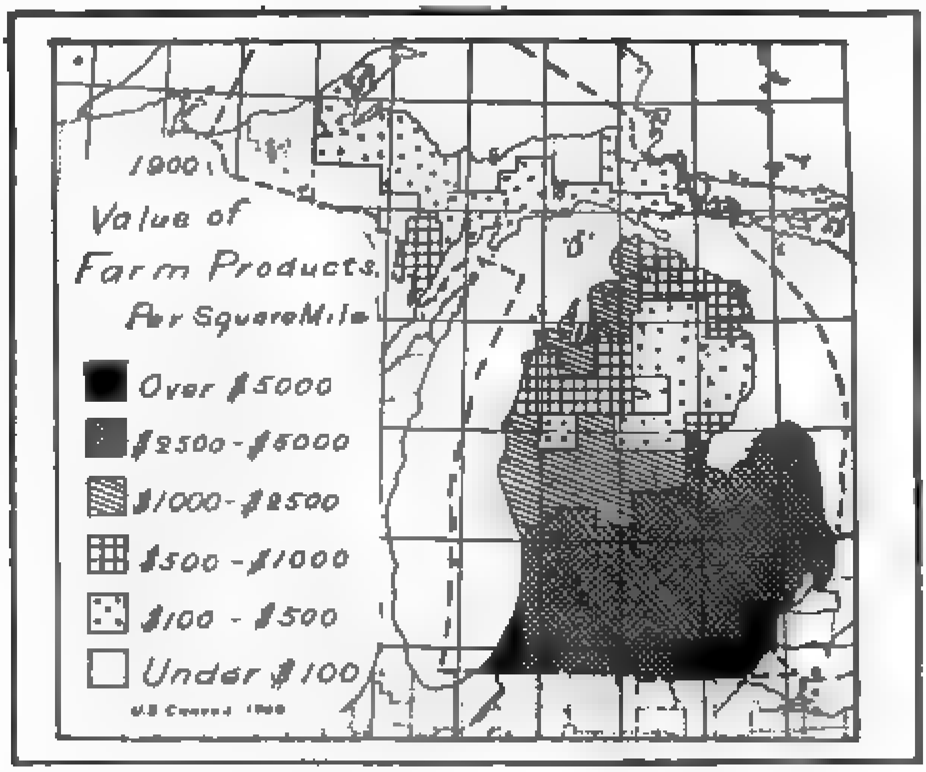

FIG. 206.—Farm products in Michigan. (After A. E. Parkins.) A good illustration of the way glaciers have laid out the occupation of men—rough land having prohibited plow agriculture.

trunks in between the rocks, send their roots far down into the moist glacial subsoil which is richer than the subsoil of Indiana, rear their heads into the abundant sunshine, and *produce*. What care they for rocks? If there is earth among them, the tree roots will find it. If the rocks encumber the surface they merely serve as a mulch to keep in the moisture.

What New England and all hill countries need more than any other thing in the whole list of relations between man and nature is an application of science to give them an agriculture that is adjusted to their unplowable soils. The present agriculture of

New England is an imported misfit from the lands suited to the plow.

Everywhere east of the Mississippi trees will grow where there is earth standing above the water level. With the properly improved varieties of tree crops there is no reason why Massachusetts might not, square mile for square mile, produce as many fat pigs or fat sheep or fat turkeys as Kansas does now—possibly more. The proper succession of fruiting mulberries, persimmons, chestnuts, walnuts, pecans, hickories, shagbarks, filberts, and many other tree crops that might be introduced from this and other lands would give us an abundance of good food or one continuous succession of workless harvests to which the pigs, sheep, and turkeys could walk and eat if man himself did not want them.

Thus may the eastern country double its possible production. The one-third that is now too hilly for good cultivation will, with tree crops, double and more than double its present meager output. The roughest third, now hopeless of tillage, can with tree crops match in productivity the best third which should remain for the agriculture of the plow, to which it is by nature adjusted.

The benefits that tree crops can render the arid and semi-arid land are equal to if not greater than those that may be conferred upon the hilly lands. The grasses, grains, and ordinary forage plants are ill equipped to fight for life against the rigors and uncertainty of aridity. Corn, for example, must have water within a certain two weeks or it is blasted, but trees can prepare for a siege. In the first place, their roots can go down indefinitely deep. These roots can store up energy, and when the time comes they can make fruit. Further than this, many of the trees of the arid lands are legumes, with the legume's power of gathering nitrogen from the air, leaving a part of it upon their roots to enrich the soil, and using the rest to make seeds that are rich in nitrogen and, therefore, meat substitutes and tissue builders.

A claimant for superiority in the possible desert harvest is the wide-pod thorny honey locust, a leguminous tree with a big pod easily picked up and full of rich beans, often analyzing over 50 per cent. of sugars and starches and also high in protein. This tree also will grow on many of our plains now almost worthless,

and its seed is one of the richest of all stock foods. It nearly duplicates in quality the carob bean, the "locusts" of John the Baptist's desert sojourn. This leguminous tree is now a crop grown in all Mediterranean countries, and the beans are largely exported from Cyprus to England for stock food. In Spain it is the oats of the cavalry horse. A little of it also comes to the United States for manufacture into a milk substitute for calves.

This honey locust is but one of nature's many desert possibilities. One of the botanists of the Department of Agriculture has found six species of woolly fruited wild almonds growing on the desolate shores of Pyramid Lake in the so-called Nevada Desert. The desert may yet bloom with almonds, for these six varieties bear nutritious though small and bitter fruit, and Mr. Frank Meyer, Plant Explorer of the Department of Agriculture, brings back from central Asia the seeds of wild almonds producing good fruit and good edible oil in a climate with an estimated rainfall of 8 inches per year.

Foreign lands certainly have great numbers of promising trees to offer us when once we set out in earnest to breed up tree crops. If we will, it seems that we may easily breed the crop-yielding trees and convert hundreds of thousands of square miles of almost vacant western range into fruitful orchards for the fattening of beasts or the feeding of men.

This belongs more in the class of probabilities than among mere possibilities, as witnessed by the experience of Hawaii with the Algaroba, a species of the mesquite which will grow in considerable areas of the United States. Hawaii has, after many difficulties of a mechanical nature, learned to grind up the beans and pods of the Algaroba bean, and thereby added an industry of great promise. The meal resulting from this grinding is worth \$25.00 a ton as a stock food, and is the "mainstay" of the dairy industry of the Islands. The Hawaii experiment Station states that an algaroba forest yields four tons of the beans to the acre per year, and one ton of wood. The labor of production consists of picking up the big beans which grow upon a leguminous tree introduced about the middle of the last century from Peru. This yield should be discounted by dwellers in other lands, because of the phenomenal fertility of the volcanic soils of Hawaii, and the tropic growing season.

The tree-crop possibilities of the fecund tropics are beyond escription or even reference here, but it should be remembered at in comparison to it the temperate zone is a land of poverty f plant species.

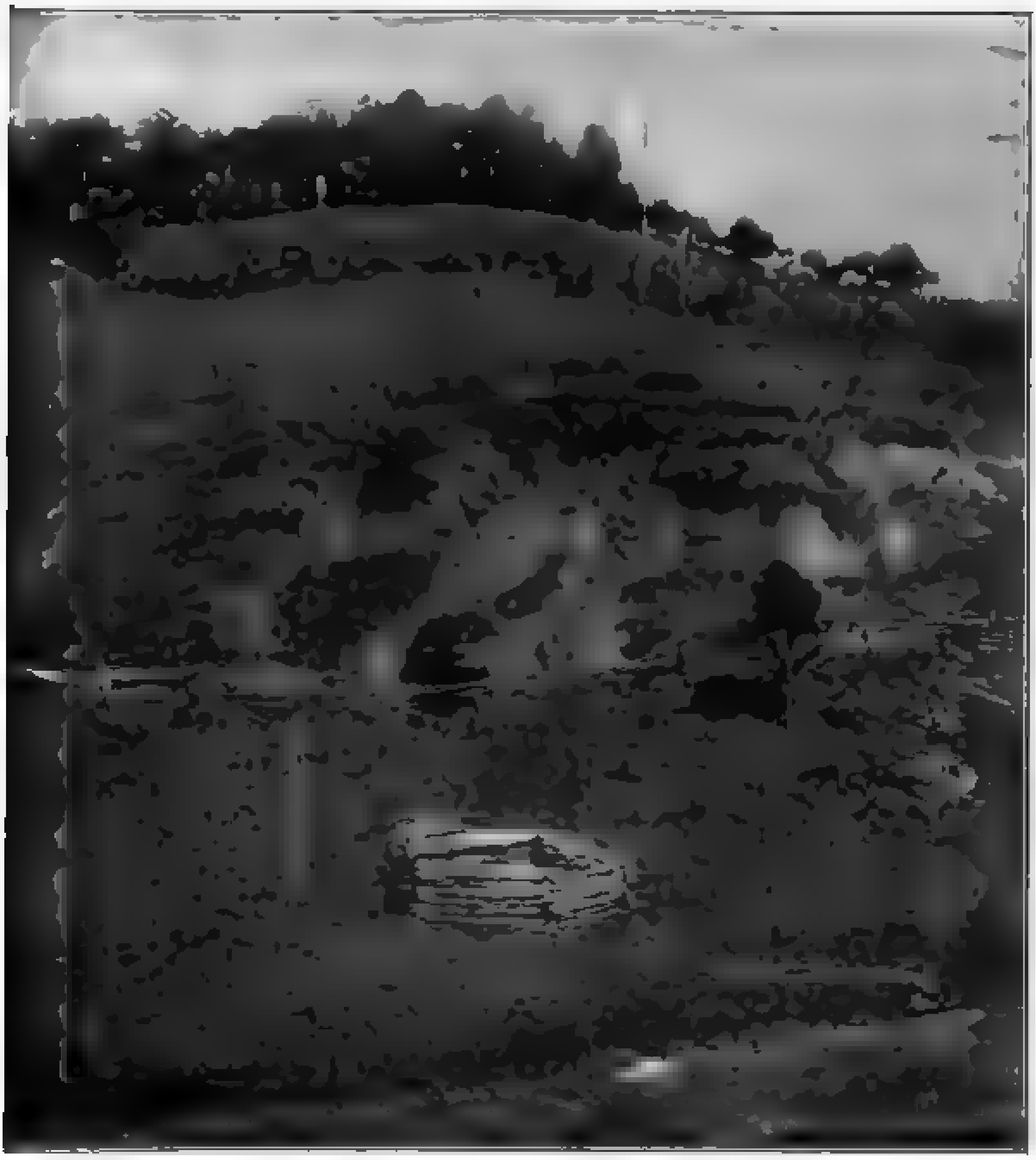

Fig. 207.—Scene in the Piedmont section of North Carolina. Hill ruined y erosion while in corn—a land-destroying crop. Girdled trees, wasteful rail ences. (U. S. Dept. Agr.)

Man has thought of himself as depending upon a *field* in which o grow his food, but there seems abundant reason to believe that cience can, through tree crops, now give him food from any land hat grows a forest, and from much land which now grows almost

nothing. Further than this the tree crop will have a valuable by-product of wood, a material of which there is now a painfully increasing scarcity. Owing to the long time involved and the consequent impossibility of financial return to the individual, the breeding of these tree crops must depend largely upon governments, and governments will act in this direction only in response to the pressure of intelligence. The time for far-seeing constructive scientific work has come.

Fig. 208.—Erosion of California pasture land after too close pasturing, Marin County. (Photo G. K. Gilbert.)

After Man the Desert.—The proper development of tree crops as indicated here will effect the greatest saving in the world conservation movement—the conservation of the soil, our greatest and irreplaceable resource. The saying, "After man the desert" is much too true, as the frightful desolation of most

ent empires attests. It has nearly all come through erosion, tree crops with their earth-gripping roots will practically it all, for the tree is nature's method of holding earth on the y framework which erosion reveals so near the surface of our and mountains.

09.—A forest remnant and soil destruction on tree-stript mountains. Shansi province, China. (F. N. Meyer, explorer, U. S. Dept. Agr.)

he Ultimate Uses of Land.—The final uses of land to get imum return with conservation of the soil seem to be about ollows:

) Where heat, moisture, and fertility abound
   1. level or gently rolling lands will be tilled as at present but planted to more productive varieties of plants; and
   2. hilly, steep, and rocky lands will be put to tree crops.

) Lands that we now call arid or semi-arid can in many cases also be in tree crops.

(c) Cold lands where the cost of keeping warm is great will be left to produce our timber-yielding forests.

(d) Beyond the tree crop and forest zones will come cactus deserts and moss-covered tundra to be used as pasture ranges by animals, suited to the conditions.

(e) The bare desert, the bare rock, and the snow field will then as now remain without harvest other than

1. possible minerals where the earth is visible, and
2. possible utilization of deserts for sun-power generators.

5. THE ECONOMIC POSSIBILITIES OF THE TROPICS

The temperate zones are dwarfed into insignificance when compared to the possible expansions of industry and human support in the tropics. These regions are quite the equal of the winter lands, as a field for the creations of new resources by science. While the tropics have great possibilities in the new era of scientific industry, they have for ages lain practically unused. Considerable areas of the temperate zone, as in parts of Europe, China, and Japan, have approached the food limit, and most unfortunately a great part of the remainder of the temperate zones lies under the withering limitations of aridity and of low temperatures. In contrast to this, the torrid zone, which includes about half of the land surface of the globe, has far more than half of the area of abundant rainfall. Add to this its greater heat with absence of winter, and we behold possibilities of the growth of food plants and, therefore, possibilities of the support of population several times as great as that of the temperate zone. Despite this richness these possibilities have lain idle for unknown thousands of years, and to-day 90 per cent of the tropic forest stands virtually as undisturbed as in the day of our arboreal ancestors.[1] With the exception of certain island

[1] An excerpt from U. S. Con. Rep., Dec. 9, 1911, gives an interesting example of tropic emptiness.

"British North Borneo (area 31,000 square miles) is owned and governed by an incorporated company under a charter from the British government. The population of the colony is estimated at 180,000, made up mainly of aborigines, about 15,000 Chinese, and not over 400 Europeans.

The natives clear small patches of the valleys and hillsides, where they plant rice and vegetables for food. For other foodstuffs they depend upon hunting and fishing. The manner of farming is decidedly primitive. The hoe is the main instrument, and there is no demand for agricultural imple-

colonies which have become peopled under white man's influence and a few minor exceptions chiefly in southeast Asia, the tropic

FIG. 210.—Panama farmer's family, home, and all the tools of agriculture—a machete to cut the bushes and weeds and a sharp stick to make holes for seeds. These people are from another world, the tropic world. They have not developed from savagery through the pastoral or animal-tending stage. That is the Aryan method. These tropic people seem never to have used animals to any important extent but developed at once a hand agriculture depending largely on starchy roots, sweet potato, yam, manioc, taro, caladium and others which have been tilled so long that they have lost the power of producing seed. The banana, corn and sugar cane are important additions to this untilled soil-preserving agriculture. (Photo H. H. Bennett, U. S. Bureau of Soils.)

forest in its full force has baffled man, and he has developed only the less productive corners, where nature goaded him with

ments or any kind of hardware except the hoe and a long knife used in war and in cutting the underbrush. In all Borneo, there is not a cultivated tract of ground worthy of being called a farm. The greater part of the land is yet covered with large trees."

British North Borneo is about one-seventh of the whole island, which is as large as France and naturally several times as productive because the unending heat and moisture of the equatorial belt permit the continuous growth of crops.

difficulties, stung him into action, made him work or starve and then often starved him despite his pathetic efforts.[1] Man seems inclined to take his ease where he can and it seems to require intermittency in supplies to make him work. Thus he has, except under Caucasian influence, advanced in the tropics only on its arid edges and in southeastern Asia where the Monsoon rains of summer make a season of growth alternating with the dry season of the winter monsoon. Under this stimulus and this limitation, India and south China alone in the tropics have become populous and the occasional failure of the summer rains produces crop failures and famines—catastrophies inconceivable to us of the well-fed West. It is a curious commentary on man's relations with tropic nature that he should have become numerous where the famine comes to slay him, and that the equatorial belt with its abundant and regular rains should have remained idle until the Dutch showed us by their wonderful object lesson in Java that this is the world's natural belt of heavy population. Since 1798, the Dutch government, leaving the forms of native government alone, has kept peace in Java and to a considerable extent directed and compelled the industry of the people to provide food for home use and export. As a result the population has increased more than five-fold in a little over a century. In Java and Madura (the population is mostly in Java) there are 50,000 square miles with 30 million people, over 600 to the square mile and it is far from being fully populated. Only 40 per cent. of the land is under cultivation. There are many wild forest districts, in which the elephant and rhinoceros roam at large; and a recent European scientist has (for good reasons we believe) estimated that Java may easily support three times as many people as it now possesses. This would bring its density up to about 2,000 per square mile. By applying this figure to the whole Dutch East Indies, of which Java and Madura are a

[1] Famine Deaths.
India (from William Digby, "Prosperous British India," pp. 130–131).

1800–25	5 famines	deaths	=	1,000,000
1826–50	2 famines	deaths	=	500,000
1851–75	6 famines	deaths	=	5,000,000
1876–1900	18 famines	deaths	=	26,000,000
	Total since 1800		=	32,500,000

sample, comprising less than one-fourteenth, we would have a population three times as large as that of Europe, and ten times as great as that of North America. Population of this density over the suitable parts of the tropics would permit that zone alone to contain six or eight times as many people as the entire world now contains, and they would be far less liable to famine than they are in India to-day.

Evidence of the correctness of the high possible estimate for Java and for other tropic localities is found in the fact that Barbadoes, in the Lesser Antilles, has 1,170 people per square mile; that Porto Rico has over 300 people per square mile supporting themselves by a primitive agriculture in hilly country that is far from fully populated; that Cuba, the size of Virginia, with but 3 per cent. of the land under cultivation maintains a population of 2 1/4 million people with 47 to the square mile, there are over two persons to the cultivated acre and the character of culture is very unscientific. There is nothing exceptional about either Barbadoes or Porto Rico or Cuba, except that by the accidents of history they are used more than the rest of tropic America. If Brazil were as populous as Porto Rico, its population would exceed that of the four continents touching the Atlantic, and there is every reason to think that Brazil could easily support that many people if they chose to dispossess the monkeys, the parrots, the serpents and the other wild life now in undisturbed possession of hundreds of thousands of square miles of forest in the earth's most productive belt. The whole of Brazil and the rest of tropical South America have a population less than that of the little island of Java. This part of South America possesses, as do similar latitudes in Africa, large areas of absolutely unexplored territory. It is, therefore, perfectly natural that, except Java, the few commercial products of the equatorial belt should still be the wild products of the forest, namely, rubber and gums, palm oil and ivory, with a little cocoa, which grows in orchards little better than a modified jungle. The jungle is an almost untouched resource teeming with possibilities of crops and food.

The Inhabitants of the Tropics.—If the tropic jungle becomes a field who will labor in it? If three centuries of colonization have shown us anything they have shown that it will not be the

white man. The white man has settled all these tropic shores—the Spanish main, the Indies East and West, Africa, South America, and Asia. He settled them before the United States was settled and he has settled them since. He has repeatedly settled them and the settlements have always melted away. The white man is a product of the temperate zone. We do not like heat. We fly from it as it shows itself in the summer of Washington, New York, Boston, and London, and the unending heat of the tropic lowland is one of the persistent forces of nature that, as a people, the Caucasians have been unable to withstand. In three centuries of trial on every tropic shore, there has been no single case of a group of Europeans who have physically thriven, increased from generation to generation, and maintained the culture of the founders.[1] Several races, as the Malays, the Negroes, the Hindoos and the south Chinese, have by many generations become adjusted to this climate of which they are a product. They can live and work and increase on the tropic lowland—witness Java. The white man can only come in as the ruler, the capitalist, the plantation manager, the engineer, the sanitarian, the expert, and the professional man.

The distribution of population in tropic America affords excellent illustration of the influence of climate on the white man and the location of his home. These countries are all under the dominance of the Spanish and Portuguese, races which are supposed to be more resistant to tropic conditions than other white races. Yet in all tropic America, with the single exception of Rio Janeiro, these races have placed their capital inland on the plateau to get away from the tropic low plain. This was done, too, with great effort, as shown by the labors incident to carrying on trade in the pre-railroad epoch between the port and the capital, hundreds or thousands of feet above and many miles inland. Thus the capital cities of Ecuador

[1] The population of Jamaica shows an interesting analysis at the end of three centuries of repeated colonization by strange races from Europe, Africa, and Asia—from the temperate and from the tropic lands. That island has had the incomparable advantages of 250 years of British rule and a large amount of plateau with its cooler climate. Adjustment of these forces shows a population of nearly 200 per square mile and 2.3 per cent white, 76 per cent black, 19 per cent "colored," 1.8 per cent East Indian. Within twenty years the increase of the colored races has been over 200,000 and the white population is now about 15,000.

and Colombia under the equator are over 300 miles from the sea and nearly two miles in elevation, with all the hardships of travel and agriculture that that elevation involves—but with a cool climate. Even Costa Rica has its capital at an elevation of nearly a mile. The only exception to the plateau location of Latin-American Capitals is Rio Janeiro, a city upon the edge of the tropics, with a plateau immediately in the rear, and on the plateau a suburb containing the residences of the dominant

FIG. 211.—Native house and unplowed corn patch in Panama on land that has been cleared, put in crop and abandoned for a time and then recleared, for four centuries and probably many more. The land has never been plowed. (Photo H. H. Bennett, U. S. Bureau of Soils.)

whites and the foreign colony. The significance of these city locations becomes greater when one notes that the location of every capital in north Europe is either a seaport or so low in elevation as to be reached by efficient water transportation.

Despite this retreat of the white race to the cool interior, they have always remained a small, very small minority, and the native Indian makes up the bulk of the population and the half breeds the second element in numerical importance. But the handful of white people rules—a fact not without significance.

If these vacant tropic plains which we claim, but may not inhabit, are to become peopled, it apparently must be by the various black, brown, or yellow races that have become adjusted to the tropic climate.[1] Left to their own desires, they have produced tribes of savages with Sultans, wars, murders, piracies, slavery, and pestilences that effectively kept down population. They have never yet developed even a second rate power or civilization and have fallen an easy prey to colony-annexing European powers. Given order and protection and guidance as in Java, they clear up the jungle, populate the earth, and have crops to sell. Thus, by the aid of the acclimatized peoples and apparently thus only will these untouched continents yield unlimited amounts of rice and rubber, sugar, cocoa, oil and nuts, cotton, hemp and other fibers, and a whole host of tropical products which we can buy with our northern goods, especially the products of factories located in comfortable climates.

Relation of Tropic Peoples to Northern Prosperity.—The development of the dense populations of the Barbadoes, Porto Rico, Java, and Bengal shows that these lands are almost certain to remain essentially agricultural, or at best, in a low stage of manufacturing. The tropic lack of ambition means that they will probably stay indefinitely as colonies or in a low stage of political power. The white races of America and Europe would have nothing to fear from three or five to ten billions of black, brown, or yellow people in the torrid zone. They would be non-militant agriculturalists, carrying out, as now, the instructions of white men, and our trade with them, largely the exchange of manufactures for raw materials, would be a great source of temperate zone riches, and would easily enable northern lands to double their population. The sooner we recognize and act upon the fact that we have a brown man's world and a white man's world, the more comfortable we will all be.

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GENERAL REFERENCES FOR PART II

In the main, the second part of the book has been worked out from such fragmentary sources that satisfactory references for class use are not available.

Teachers who are having their students make reports may find this part of the book a fruitful field. Standard reference works—atlases, consular reports, U. S. Government reports on foreign commerce of United States, advertising matter of transportation companies, the annual volumes of encyclopedias, the statesman's yearbook—these and many others give fruitful material for the working out in greater detail of many points in Chapters III to XI, inclusive.

SMITH, J. RUSSELL.—*The Ocean Carrier*. Putnam's. Goes quite fully into the ground covered by Chapters II and XII, and touches to some extent on the subject matter of the intervening chapters.

Those caring to go more fully into the theory of the Balance of Trade will find it covered in treatises on Political Economy.

Chapter XIII is partly covered by most of the Histories of Commerce.

"Dun's International Review," monthly, New York, has for a number of years covered very closely the field covered by Part II of this book.

"Fairplay," London, and the "Marine Review," Cleveland, are two journals dealing with ocean transportation.

The Shipping World Yearbook, published by the "Shipping World," London, gives a valuable collection of data about the physical equipment and trade of all ports of importance in ocean trades. The Panama Canal is exhaustively discussed in E. R. Johnson's report to President Taft on Panama Canal Traffic and Tolls, 1912.

PART II
COMMERCIAL GEOGRAPHY

CHAPTER I

THE LAW OF TRADE

Commerce exists because individuals and peoples, having 'erent goods, exchange their surplus to mutual advantage. is difference in the production of peoples arises from three main sons—first, the difference in the peoples themselves; second, differences in the stages of industrial development; and, third, difference in the resources of their respective lands.

Racial Differences.—The first reason for a difference in pro- ction arises from a difference in the peoples themselves. The anese and Chinese export to other countries their porcelains, quer ware, metal work, fancy paper goods, and other products, ich have their distinctive character and value because they ect a skill peculiar to these oriental peoples, whose culture is so 'erent from our own. From India come many carvings and ios, which are prized as examples of Indian art. The chief nmerce of some American Indians is in basketry, blankets, ch bark work, and other products of his own tribal life, and na- e arts and crafts. Among the peoples of Western civilization, French are conspicuous in commerce through the export of ducts which are valuable because of the French skill and taste ich give them a superior artistic character, and make them cious to the lovers of the luxurious and beautiful everywhere. rman commerce has reached an important position partly ough the influence of the scientific attainment and thrift of German people. This is particularly true of their leadership the chemical industries and the industries that have through ir chemical basis a close dependence upon the laboratories the nation which has led the world in chemistry. It may at t thought seem that the difference in the skill, genius, or culture races is the greatest cause of trade; but this is not the case. cial difference is the least important of the three main causes.

Racial differences and their commercial results are conspicuous for their tendency to be evened up and to disappear. The relative advantage of German scientific leadership is passing because the Germans themselves are teaching other peoples their own sciences and arts. America, Japan, and England are copying German sciences and scientific instruction with all their might, while the Japanese art products are declining because of the influence of European and American machine manufacture under the factory system. The arts of the Indian and the tribesman everywhere tend to vanish before the machine-made product of world commerce. This is usually a great blow to tribal life.

Difference in the Stage of Industrial Development.—The second cause, a difference in the stage of industrial development, is much more important in explaining the world's present commerce. The difference in stage or intensity of industrial development is largely a matter of the density of population. Two people to the square mile will inevitably support themselves by means which differ greatly from those that will be adopted by 200 people per square mile in the same kind of territory. The sparse population seizes upon the raw products of nature, or produces raw materials requiring the least labor. A dense population, having few raw materials per capita, must fabricate them to a high degree to make value. In the new forest lands, one person to two or three square miles, will make a satisfactory living by the trapping of fur-bearing animals and the gathering of gums, herbs, and roots. A population slightly more dense will cut down the forest and sell logs as lumber. If this sparse population is upon the open plain it will employ itself in tending herds of sheep and cattle, and will export wool, hides, and animals. If the population increases and the climate is suitable, the level plain will be carelessly plowed up and sown to grain, which will be exported to the densely peopled region.

This, in brief, is the explanation of the great commerce of the second half of the nineteenth century. The European peoples settling the comparatively empty lands of America, have been producing wheat and sending it back to the better yielding wheat lands of Europe; they have been sending cattle, butter, and cheese to the European countries, where the pastures are fatter and cattle more numerous per square mile; they have been exporting

lumber to the countries where the forests are better kept, because the European population is dense and the American population has been and still is relatively scanty. This is the chief explanation of the commerce between the German-American or Scandinavian-American in Dakota with the people of the Fatherland, or the grandsons of the Englishmen in Nebraska with the people in the old country. We even send to and get from Europe articles of the same material but of different degrees of manufacture. Thus we export raw cotton and buy fine fabrics and lace; we export logs and planks and import wood carvings from Switzerland and the Black Forest region of Germany; we export sole leather and import the fancy tans of France and Germany; we sell steel rails and pig copper and buy cutlery and scientific instruments; we send coal tar to Germany and bring back the drugs and dyes that her chemists make from it.

Owing to the westward movement of the main line of migration and settlement we see, within the old world itself, a duplicate of the trade that passes between America and Europe. The densely populated manufacturing parts of Europe, west of Vienna and Berlin, carry on a most active commerce with the territories of the Baltic and Black Seas, deriving from them products identical with those that come from across the Atlantic. These manufacturing regions have been sending to us and to eastern Europe woolen goods, cottons, silks, leather goods, machinery of all kinds, metal manufactures, cutlery, gloves, lace, and the thousand products which reflect the much labor and the relatively small raw material of densely populated regions. The new outposts of Western civilization in Australia and the Argentine Republic are to manufacturing Europe but two other Missouri valleys, with grain fields and sheep and cattle ranges, inhabited by people who buy their manufactured goods and pay for them with grain and animal products. This trade will appear wherever these differences of population are found and land permits. Thus in Roman times, France and west Europe sent to Rome furs, cattle, timber, food and slaves in return for the more valuable goods of Rome. Today these conditions, with the exception of British coal, are reversed in the trade between Britain and Italy. This basis of trade, like that depending on racial differences, from which it cannot completely be distinguished,

has a strong tendency to disappear through the equalizing of industrial conditions throughout the world.

The United States and Germany, which for a time were England's great market for her manufactured goods, are now rapidly developing the same industries, and are becoming the great rivals of England. Within the United States itself the whole development is shown. New England duplicates old England in more than name. It is little more than a group of towns and cities whose people live by fabricating raw materials, most of them imported, and sending the product chiefly to the West and South in return for the food and raw materials of those newer and less populous sections of the country. Ohio, which, fifty years ago, was to New England both market and source of supply for food and raw materials, is now becoming her rival and turns for her supplies to the yet newer West. The cotton industry of America, once centered in New England, is rapidly being built up in the South; and all kinds of manufacturing is going on in greater and greater quantities beyond the Alleghanies, so that the North Central States are coming to resemble New England as New England has come to resemble old England. Every state and every country desires manufacturing industries, and they are increasing in every state in the Union, and in almost every foreign country. Lastly, but by no means the least important, comes the emigrant to even up the population physically and complete industrial similarity, so far as it pertains to the labor supply. The cheapness of the Atlantic passage and the distribution of knowledge of American industrial conditions throughout Europe permit greater and greater movements of people to America, to take advantage of her industrial opportunities. Already more than a million have come in a single year, and there is no reason why, in a few generations, this country shall not become as fully peopled as is Europe.

This growing likeness in industries and population is accompanied step by step by the cessation of trade in those articles for which the necessity ceases as America comes to produce a product previously secured in Europe. A few decades ago most of our iron and steel was brought from England. Now we export it occasionally to England. The import of textiles, chemicals, and other manufactures is falling off in consequence of American

production. The large trade in sub-tropic fruits and dried fruits from Mediterranean countries has almost entirely ceased through the development of identical industries in California.

Difference in Resources.—The third basis of trade, that arising from difference in resources, is one of increasing importance and is one which man affects but little, a fact which will become of greater and greater influence the more fully we adapt our use of each section to its resources. The chief of these differences are those of topography, soil, moisture, nearness to sea, and temperature.

Differences in topography give rise to a trade which will endure. The products of the well-used mountain and of the well-used plain must forever be different. The rough, rocky and steep lands cannot be tilled; but they are the natural home of the forests, of wood and tree products, and of the mining and quarrying industries. The full utilizing of mountain countries means therefore minerals, wood, nuts, fruit, water-power, paper, and the possibility of printing and publishing and the manufacture of varied light imported raw materials through water-power. But the mountain needs the agricultural products of the open plain, grain for bread, animals for meat, wool and cotton for clothing, and the many other products of agriculture, which can be paid for with mountain products. Such is the trade that does now and may for centuries pass between the prairies of west Canada and the glacial regions north of the St. Lawrence, between hilly New England and Appalachia and the level West.

Soil differences also make trade. Along the banks of the Mississippi, in southeastern Iowa, are glacial sand plains in the midst of the fertile black prairies of the corn belt. The sand plain, too poor to grow corn, just suits melons and sweet potatoes, which the farmers grow in large fields, and peddle in wagon loads across adjoining counties, or ship by train loads to adjacent states to be bought up by people who can grow corn, but who cannot, on their richer, heavier, more valuable lands, grow good melons or potatoes. This example is typical of the vast trade that is now developing between the sandy districts in the Atlantic plain and elsewhere, and the rest of the United States. Though the most conspicuous, this soil difference is but one example of many others.

The differences in moisture give us the humid and the arid lands between which there is a great and growing trade. Beyond the bounds of cultivation in all countries are the sheep and cattle ranges, where sparse population has two or three products to sell, and must buy most of its food from more favored farm lands, and must secure from the manufacturing towns all the other

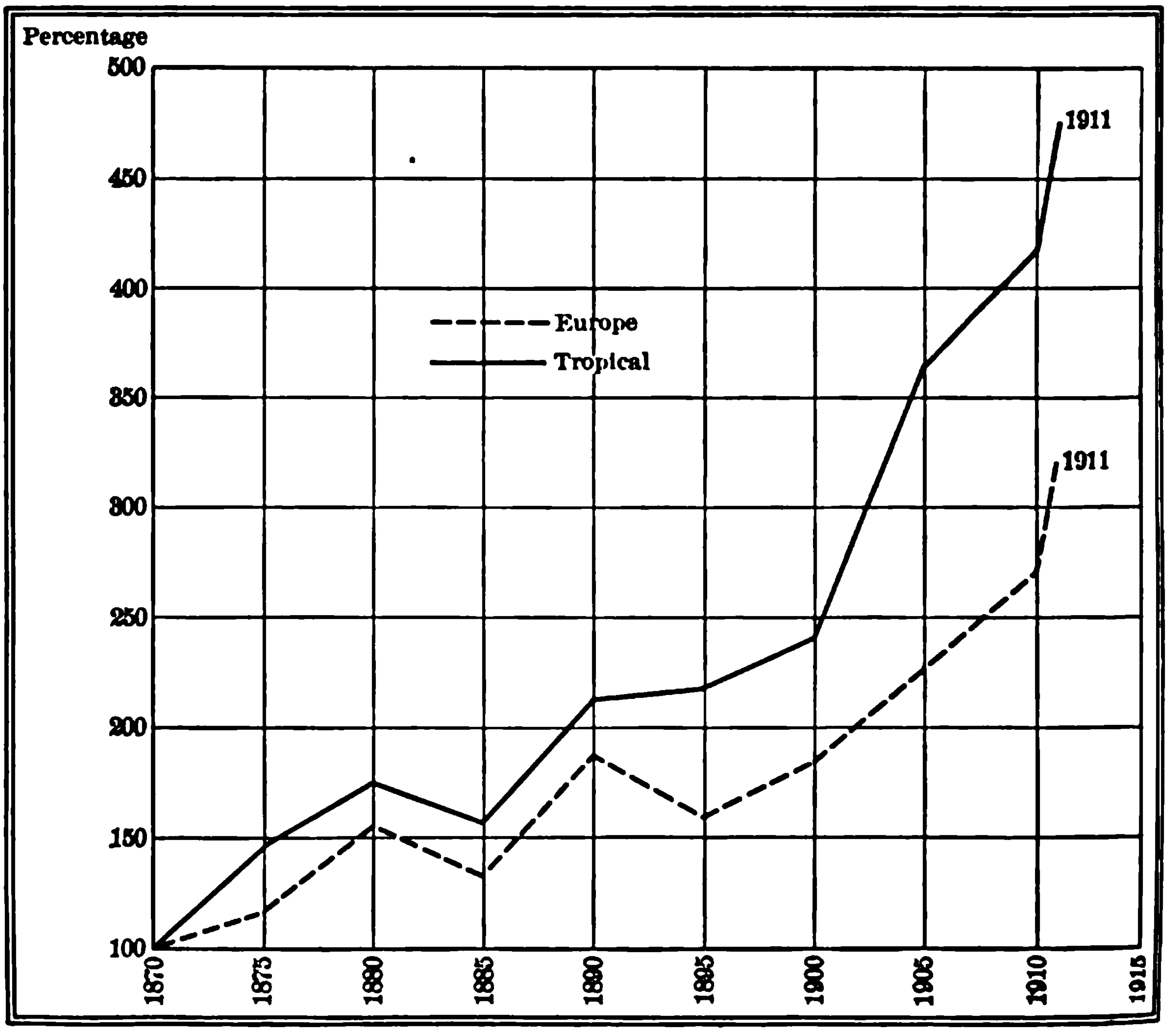


Fig. 212.—Comparison of increase of imports into the United States from Europe with increase of imports of tropic products. Tropical products according to United States Bureau Statistics classification are cocoa, coffee, fibers, rubber, indigo, ivory, licorice, olive oil, rice, silk, sugar, tea, tobacco, vegetable oils (using values in 1870 as base or 100 per cent.).

products that are to be purchased in the store. In the irrigated oases of the arid lands, dried fruit is produced most easily; and it is already being sent from these favored spots in Australia, in Argentina, in Chile, in Europe and in the United States to the more humid districts, which can with ease produce other products for exchange. This exchange of dried fruits and animal

products for grain and manufactures is world wide and seems to be as enduring as the distribution of people and variation in rainfall.

The shore lands and the inland region have an enduring trade in the fish, of which the rocky and even untillably cold coast has at present a great wealth, enabling it to command the products of all other climates.

Temperature as a basis of trade is the most fundamental, the most widespread, and, for the future, the most promising of great and yet greater performance. No exchange of culture, no equality in education or skill, no emigration of peoples evening up density of population can change the temperature and make tropic fruit grow in the land of arctic fur, or cotton grow in the land of spring wheat. If America becomes a second Europe, Manitoba will have a lively trade with Texas, because Texas can produce cotton and other sub-tropic products, which the short summer forever bars from Manitoba. Florida and other southern lands will send their oranges and vegetables to the northern lands of frost when the latter's agriculture is frost bound; and the North will send in return its wheat, the red apples from its hills and the myriad products from its mills. Examples in miniature often permit us to see the tendencies of the time more clearly than larger and more complicated examples. Thus the Canary Islands, snugly fixed on steamer routes in the frost-free waters of the warm Atlantic, have within thirty years developed an export of over 200,000 tons per year of bananas, tomatoes, and potatoes, mostly to the English market.

The Future Course of Trade.—This north-south trade is the trade of the future. It is complementary to our production and is needed to round out the economic life of northern and southern lands alike. The most important class of commodities is tropic and sub-tropic foods. We want their cane sugar, their cacao, their coffee, their rice, their spices, their bananas and other fruits; their coconuts, their Brazil nuts, their palm nuts, their tapioca and many minor products. We want, for our mills, their raw materials, rubber, Manila hemp, jute, henequen and other fibers; their cabinet and dye woods; their rattan, gums, palm oil and other forest products. In exchange for these the

northern lands are sending machinery, clothing and all kinds of manufactures and some foods. This is a natural trade.

At the present time the great bulk of our commerce depends upon differences in the stage of industrial development—east and west trade—but the future is indicated by changes now in progress. The greatest rates of increase are taking place not along east-west lines, but in the trade of temperate with tropic regions; and, if the present rates of increase in this traffic continue throughout this century, it will far surpass that on the east and west lines. The east and west trade will probably not decline in absolute quantity, but will become relatively and gradually less important as the world's commerce multiplies itself many fold, as it inevitably will if its present tendencies continue.

Size of Country and Volume of Foreign Trade.—Foreign trade, depending thus upon natural laws, modified by man's aid and interferences, is of varying importance in different countries, with the general tendency to be least important in large countries and most important in small countries. China peacefully and successfully ignored the foreign world for many centuries, because she is a world within herself, reaching on the south to a latitude of Havana, on the north to the latitude of Newfoundland, producing cotton, rice and wheat, and reaching westward across semi-arid and arid pastures to the deserts of central Asia. The world could give her nothing that she did not produce. She therefore scorned the world. Petroleum, cheap cotton cloth, modern machine manufactures and new machinery have tempted the Chinese to buy; but their foreign trade of less than one dollar per person is insignificant to-day. The foreign trade, however, of a country like Uruguay, a little fertile cattle and sheep ranch, is over $60 per person, among the highest in the world, because Uruguayans produce essentially one class of articles, with which they must buy everything else which a civilized people consumes. Small countries like Switzerland, Belgium and Holland, with almost no variety in climate, and accompanying small variety of resources, have a relatively enormous foreign trade. So does England. So would New England, if we had the figures of commerce that cross her southern and western boundaries. But most of New England trade is with other states of the Union, and disappears without statistical

record in our vast domestic commerce, which is said to be more than twenty times as great as our foreign commerce. If all Europe were but two nations, corresponding to the United States and Canada, most of her astonishingly vast foreign commerce would disappear, because the commerce of England or Germany with west Europe and Russia would be like that of our northeastern with our southern and western states. Our great area and variety of resources gives us a smaller per capita foreign commerce than that which is shown by the countries of Europe, especially such small countries as Denmark or other western European countries.

To see commerce in its extreme development we should look at the Falkland Islands, a wind-swept sheep-range with an area of 6,500 square miles, and a population of 2,300 people, whose foreign trade is about $600 per person per year. This only slightly surpasses the little French colonies of Miequelon and St. Pierre—a few thousand fishermen and ship outfitters on two barren rocks in the cold Gulf of St. Lawrence, who import and export each year the enormous total of about $500 for every person in the colony. In contrast to this the per capita foreign trade of the United States is less than $40, and of Great Britain is about $100 per year.

CHAPTER II

THE WORLD HIGHWAY—THE OCEAN AND ITS CARRIERS

To understand world commerce we must first know the part played by the ocean. The nation that does not touch the ocean is like a house that is not upon the street, and some of the bitterest strifes of history have been for the possession of bits of coast. Once a nation has reached the sea it has possessed itself of a part of the world highway that reaches everywhere and belongs to each and all who own even a tiny strip.

The Freedom of the Highway.—It is an adage that ocean transportation is cheaper than land, but it is difficult for the landsman to realize how much ocean carriage differs from land carriage in cheapness and in the freedom of competition. This freedom is chiefly due to the same cause which produces the greater cheapness of transportation, namely, the fact that the ocean carrier must furnish only the vehicle, while nature furnishes the roadway, and, in some cases, even the motive power—wind. Upon the railway the cost of the vehicle is an insignificant part of the total cost of service. The important thing is the way itself. The names of the two means of transportation show this. Upon the sea, we speak of ships, which are vehicles; upon the land, we speak of the railroad, which is the way.

The Freedom of the Terminals.—If the steamship company does not find terminal facilities, it can go to some other port where they are provided, the freedom of the sea permitting it to go with perfect ease. The ambition of cities makes them provide the needed facilities for ships if they would have trade. This is true because any city, no matter how insignificant or poorly located, has ambitions for world trade, and since no steamship company can give this no city will give away the monopoly of its ocean terminals. Accordingly, the place for the ship to unload is usually found with comparatively small expense to the ship, so that

ean transportation remains competitive and cheap both on the ternational high sea and within the shadow of the land.

The Two Types of Ocean Service.—This freedom of the highiy and of terminals results in a great variety of traffic methods, t the whole of ocean commerce may be divided into two large isses. 1. The line traffic, with which everyone is more or s familiar, carries the passengers and mails and certain kinds

a. 213.—A tramp steamer in dry dock shows how nearly cubical she is—about 81 per cent.

freight. It corresponds to the express and fast freight business the land. The line service is in the public eye and achieves a gree of attention which is much beyond its relative merits. Charter traffic; single vessels operating as units, as is any agon that is for hire on the street corner, handle the larger part the ocean's freight. It is an individual matter entirely be-reen the shipper and the ship owner. The business is not

heralded by expensive advertising, fine engraving and handsome cuts distributed throughout the five continents. All this publicity is costly. The individual ship, which is known as a charter ship, or more commonly as a "tramp," is on the list of some ship-broker or brokers who secure a freight for her on commission, and she goes about her work unnoticed by the traveling public or by the headlines of the newspapers. She is reported only in the maritime columns of the business journals, and is watched only by those whose business it is to know about her travels. But she carries a large proportion of the world's freight.

The tramp vessel that is free to go when work offers, and to lie in port when it does not offer, has a distinct advantage over the line vessel, which must go on a certain date, full or empty, must maintain a schedule and make sailings to ports of call, which in themselves are often unprofitable, but which are necessary, since a line vessel must maintain a reputation to establish relations with shippers and form a clientele. The ambition of the liner is regularity and reliability; the ambition of the tramp is cheapness.

The Charter or Tramp Vessels.—The freedom of the sea makes competition easy, but it is especially easy among the tramp vessels. When a great line is established, full competition can only take the form of another great line, which involves much capital and careful organization. Competition in the tramp service requires merely another ship. It does not even require that the owner shall be a successful manager. He may rent his vessel out to another, who has the necessary acquaintance with the trade, or he may secure a manager who will receive a salary or commission. Any person who has the necessary two or three hundred thousand dollars can go to any one of the scores of ship-builders and have a tramp steamer built in a few months. He can have a ship built on part borrowed money, the builder taking a lien on the ship; and when she goes to sea she will go mortgaged. Or, if the newcomer should desire to engage in the ship business and does not care to wait for the ship to be built, there are numerous ship-brokers who will sell him one within an hour. The owner of this single ship is then in a position to compete in the world's freight market, and can take service on any sea, in any country and from hundreds of ports. The ocean is a world

ocean; the ship market is a world market; the charter traffic is a world traffic; and the ocean rate a world rate. If there is grain in volume in the Black Sea the ships go there, and the same is true of India, Australia or South America. Wherever freight offers, there the ships may go and do go; so that, although industry and railway transportation are local matters within a particular country, ocean carriage is absolutely international, and reflects world conditions which are often directly opposite to those prevailing in any particular country. For example, during the bounding prosperity which prevailed in this country between 1901 and 1905, there was worst shipping depression ever known.

The Tramp Traffic.—This tramp steamer, which may be built and owned by anybody, and which may sail in all seas, and carry the products of any or all countries is a remarkably free agent. It is to be had, however, only by those persons who can afford to load a whole ship; and that is about the only limitation upon the character of produce that is carried by the tramp vessels. First in the class comes grain; then we have sugar, cotton, ores, coal, nitrate of soda, lumber, china clay, petroleum and many other bulky raw commodities. Only occasionally some manufacturer ships enough heavy goods, such as steel rails, locomotives and agricultural machinery, to fill a vessel, in which case he almost invariably charters a tramp. The regions producing the tramp freight and the regions consuming the same are widely scattered and embrace every important country in the world. For example, grain is shipped from our Pacific coast, our Gulf and Atlantic ports, from the Argentine Republic, from Australia, from India, from the Black Sea ports, from Egypt and from Baltic Russia. A further analysis of the origin and destinations of prevailing charter commodities would show that we have indeed a world problem. There are hundreds of ports with freight for tramp vessels and there are thousands of ships scattered about the world to do this work.

Management of Tramp Vessels.—The proper bringing together of the ships and the freight is a world puzzle, compared to which the game of chess is simplicity. The ships must move around the world in such a way that the freight is all carried and that the ships that do the work have as few empty voyages as possible, and keep constantly employed.

The successful adjustment of this complicated situation is one of the results of the development of the ocean cable. Lloyd's agency in Great Britain, with its branches throughout the world, reports every observed movement of more than 10,000 vessels; maritime associations in commercial ports do the same work; so that the shipowner can easily know where his vessel is and where the vessels of his rivals are. It is necessary, however, that in this work watch must be kept not only upon vessels but upon freight. Most of the products are products that depend upon harvest and commercial conditions. If there is to be a good or bad grain harvest upon the Pacific coast or in the Argentine Republic, tramp shipowners must know it and place their ships accordingly. The differing times of ripening of the various crops in the different producing regions and other particular seasonal demands make each port or district have its busy season and its off season. Accordingly, the manager of the tramp vessel has a number of problems to consider as he guides his ship through the maze of world commerce. The cable which enables Lloyd's to report the movements of all vessels, also reports the condition of crops in foreign countries, and enables the managers of the ships to maintain almost as good control and knowledge of their ships as does the chess player of the men on the board before him.

The headland that projects into a traveled sea is nearly always occupied by a signal station, where, by means of the international flag signal code, a ship captain can receive orders from his owner. Thus, the trans-Atlantic steamer coming to New York is reported from Nantucket lightship or Fire Island lighthouse, usually both. On the other side she is reported from one of numerous stations upon the English or Irish coast. From these same stations the captains of tramp steamers are receiving orders to proceed to this port or that. The grain that is sent to "Cork for orders" may be unloaded anywhere between Belfast and Copenhagen. The coasts of Africa, Asia, South America and the islands of the sea are supplied with these signal stations, so that the vessel owner in London, Liverpool or New York moves his steamer onward from station to station, as the chess player moves the men from block to block on the board before him or the train dispatcher manages the trains from his watch-tower in the center of the great urban railway station.

The manager of the tramp steamer must consider more than one voyage when he makes an engagement to perform a certain voyage, for it is necessary that his ship be discharged in a place where freight is to be secured for another voyage, and if such is not the case he may have a long voyage in ballast, making cost without income. The result is that the probable second voyage affects the rates for the first. The manager seeks an engagement which will release his vessel near good prospective freights and he avoids engagements that take him into barren seas. Accordingly this master of applied commercial geography scans the world's horizon for prospective wheat crops or other freight supplies toward which he can work his ships with a chance of securing freight.

The Tramp Freight Rates.—It is a fact that if a vessel cannot make good earnings it usually pays better to take low earnings rather than nothing. The consequence is that when freight is scarce the rates may go down not only to a point where there is no profit but below this, because each manager reasons to himself: "If I cannot make profit, it is better to operate at least at cost; if cost cannot be made, it is better to operate at a moderate loss rather than to undergo a greater loss by tying up to a pier and allowing the ship to do absolutely nothing." The result is that ocean freights may go to great depths; and, conversely, they may rise to great heights, for when the freight is plentiful and the ships are scarce the only limit to which the freight may rise is set by the limit that the shippers can afford to pay to get a particular deal consummated. No auction room or horse fair could be more competitive than the ship market. If there are two bidders the price rises; if there is one, he has his own way. In response to these primary forces, the bargainers representing the ship and the freight take advantage of every factor in sight, and freights range through hundreds of per cents.

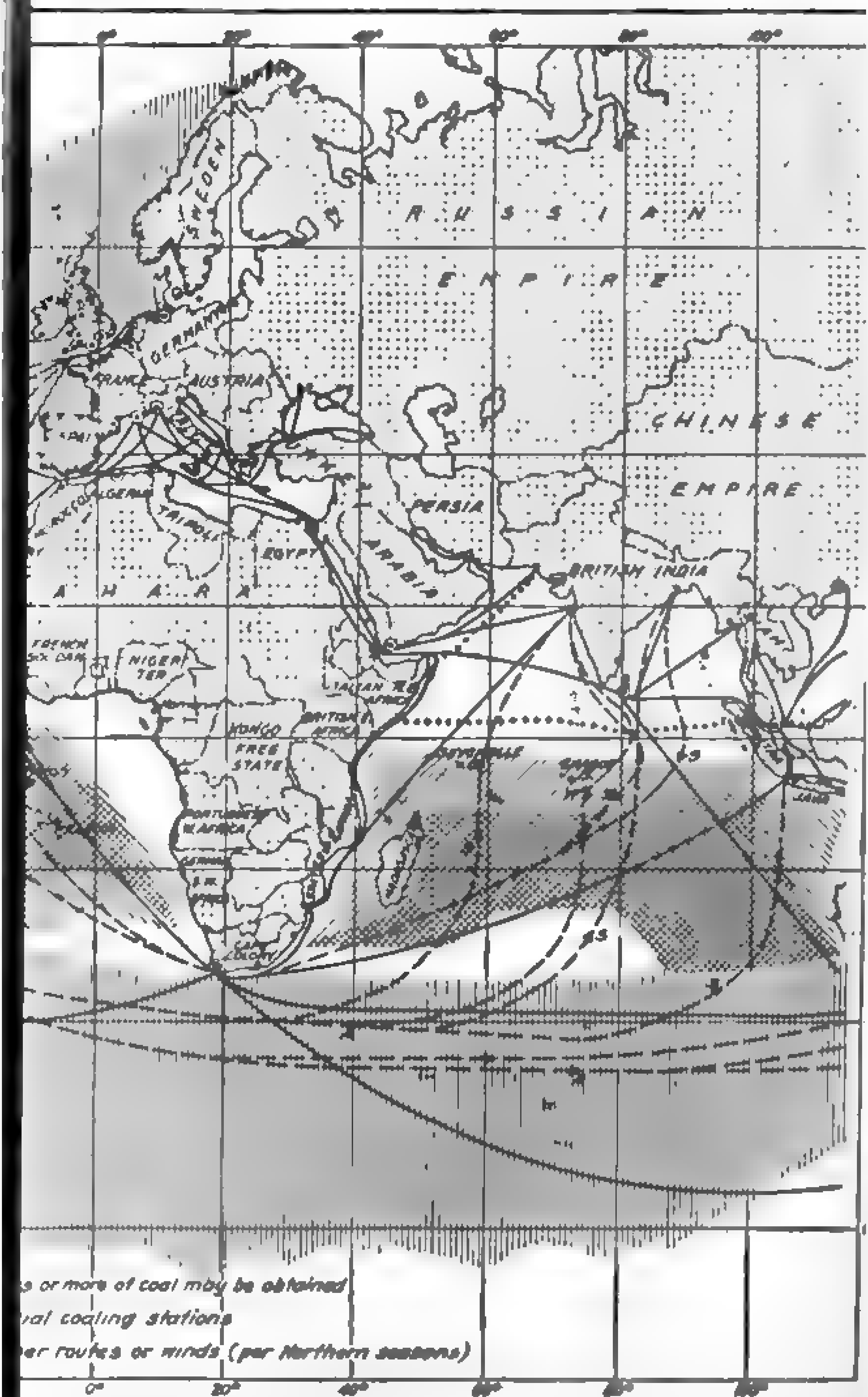
The method of making rates and securing cargoes for ships, and ships for cargoes, is best described by the relation of some common incidents of every-day occurrence. A Liverpool shipowner had a steamer in the Mediterranean loaded with jute, which she was carrying from Calcutta to Dundee. The owner desired another cargo for the steamer at the end of the voyage. Knowing that there was nothing in Dundee he wrote to his

agent in Newcastle, and himself made inquiries among the shippers of Liverpool. The Newcastle man suggested a cargo of coal to Hamburg, but it was declined; and the owner sought the aid of his correspondent in Dumbarton, but the iron trade of Dumbarton was not promising. Meanwhile the days were passing, the vessel had reached Dundee and there was nothing provided for her. The Liverpool man was himself the correspondent of a London firm of ship-brokers, who telegraphed him at this juncture that they had offers of a shipment of German coke to go from Rotterdam to Santa Rosalia, Lower California, and of another of Cardiff coal for Buenos Ayres. The first the shipowner declined, as being only suitable for a sailing vessel, and because of news from across the Atlantic he allowed the second to go to a steamer then lying at Antwerp. Three days before this he had cabled to his New York correspondent a description of the steamer, and offering her services to carry grain to the United Kingdom at a certain rate and saying that she could load after a certain date or between certain dates. As New York freight was dull, the firm in that city telegraphed their Boston and Philadelphia agencies. At the same time a Chicago grain exporter decided to export 150,000 bushels of corn, and telegraphed to his agents in New York and Philadelphia to secure offers of transportation. The representatives of the Chicago exporter and the Liverpool shipowner bargained face to face in the New York Produce Exchange. Offers were, however, made at the same rate by the New York representative of the owner of a ship then off Rio Janeiro with a cargo of Chilean nitrate bound for New York, and also by a Philadelphia broker who sought future employment for a vessel then in the Red Sea with a cargo of Java sugar for Philadelphia. The Liverpool owner was informed of this competition, and still having nothing for his steamer he cabled that he would charter his ship for threepence (six cents) less per ton, or, for the same rate, he would take freight to continental ports as far as Copenhagen. He added to his cablegram the word "range," which means in cable code that he would send the ship to the Delaware Bay with the understanding that she might be ordered to New York, Philadelphia, Baltimore, or Norfolk to load. This offer secured the freight, for the representatives of the sugar ship and the nitrate

p having more time at their disposal preferred to take chances her than cut rates. The steamer, which, pending negotiations, l proceeded to Newcastle to coal, departed thence in ballast the Delaware. Meanwhile the Chicago exporter found that road conditions made Norfolk the most convenient port to iver his corn at the appointed time. When the steamer ched the Delaware Breakwater (just inside Cape Henlopen), captain received telegraphic instructions to go to Norfolk. ere he loaded a full cargo of corn, and, as the final destination the corn was still undecided, he sailed to the Channel port Falmouth for orders. There he was instructed by signal to ceed to Copenhagen, where the corn was discharged. The sel was now ready for another contract which the agents l been trying to arrange since the day they learned of the ıl destination of the corn cargo. Wireless telegraph is perting the control of the absent shipping.

The Cooperation of Tramp Traffic and Liner Traffic in World mmerce.—This tramp traffic bears a very fundamental relaı to world commerce because it carries the heavy commodities he raw materials and food—without which the manufacturing r and the manufacturing state as at present constituted ld not exist. The era of world commerce in its present se may properly be said to have begun about the middle of nineteenth century, when Great Britain began the heavy portation of food and the wide export of manufactures. At time came the steamship, and lines were established between rope and America, and between Europe and all other countries, l between New York and the West Indies and Colon, and n Panama to San Francisco and Chile. These two types of an service work together like freight trains and express trains. tramps handle the trade of vast quantity; the liners handle trade of high value and the shipments of small size and great nber. The lines, therefore, serve the greater number of ppers. They serve the multitude who cannot fill a ship h one consignment, and among manufacturers there must be usands of small shipments of finished goods to one that uires a tramp to handle it. The manufacturing state may end upon the thousand ships that bring food and materials, there is an equal dependence upon the 300 big liners that

carry to market with greater speed the myriad small c ments of manufactured exports. Conversely the raw m producing country like Argentina depends largely upon to take its exports and upon liners to bring its imports c able manufactured goods.



ourtesy of G. P. Putnam's Sons)

CHAPTER III

THE TRADE ROUTES OF NORTH AMERICA

The surface and contour of the North American continent offer easier paths for commercial routes than those of any other continent except Europe. Most of the habitable areas are comparatively near to, or easily reached from healthful coasts and suitable harbors. The tropic section is the only exception to this, and the tropic is of far less importance than the temperate section.

The center of gravity in North American industry, population and commerce is, and will long continue to be, in the southeastern temperate region, the region comprising the Atlantic slope, the basin of the Great Lakes and the Mississippi Valley east of 100° W. This section is especially favored for transportation within itself and for access to the sea. The slowly sinking coast line affords numerous good harbors, with value increased by a moderate tide. Inland waterways are afforded by the Great Lakes, the Mississippi, the St. Lawrence, and the rivers and bays of the Atlantic Coast. There are few mountain obstructions, and the interior offers a most remarkable combination of conditions favorable to easy transportation. The Mississippi Valley is almost level, opens broadly to the Gulf and further has the phenomenal advantage of almost imperceptible passages to the Lake Basin, to the Atlantic slope and to the areas draining into the Hudson Bay and the Arctic Ocean. The problem of getting out to the Pacific is easier than crossing the Alps or the chief mountains of Asia or South America. In Mexico and Central America the mountains are more difficult and the plains less hospitable. Unexcelled climate and natural resources in the temperate sections complete the conditions necessary there for the development of trade routes unrivalled in the size and distance of their commercial movement.

We have strangely failed to utilize all our advantages, especially

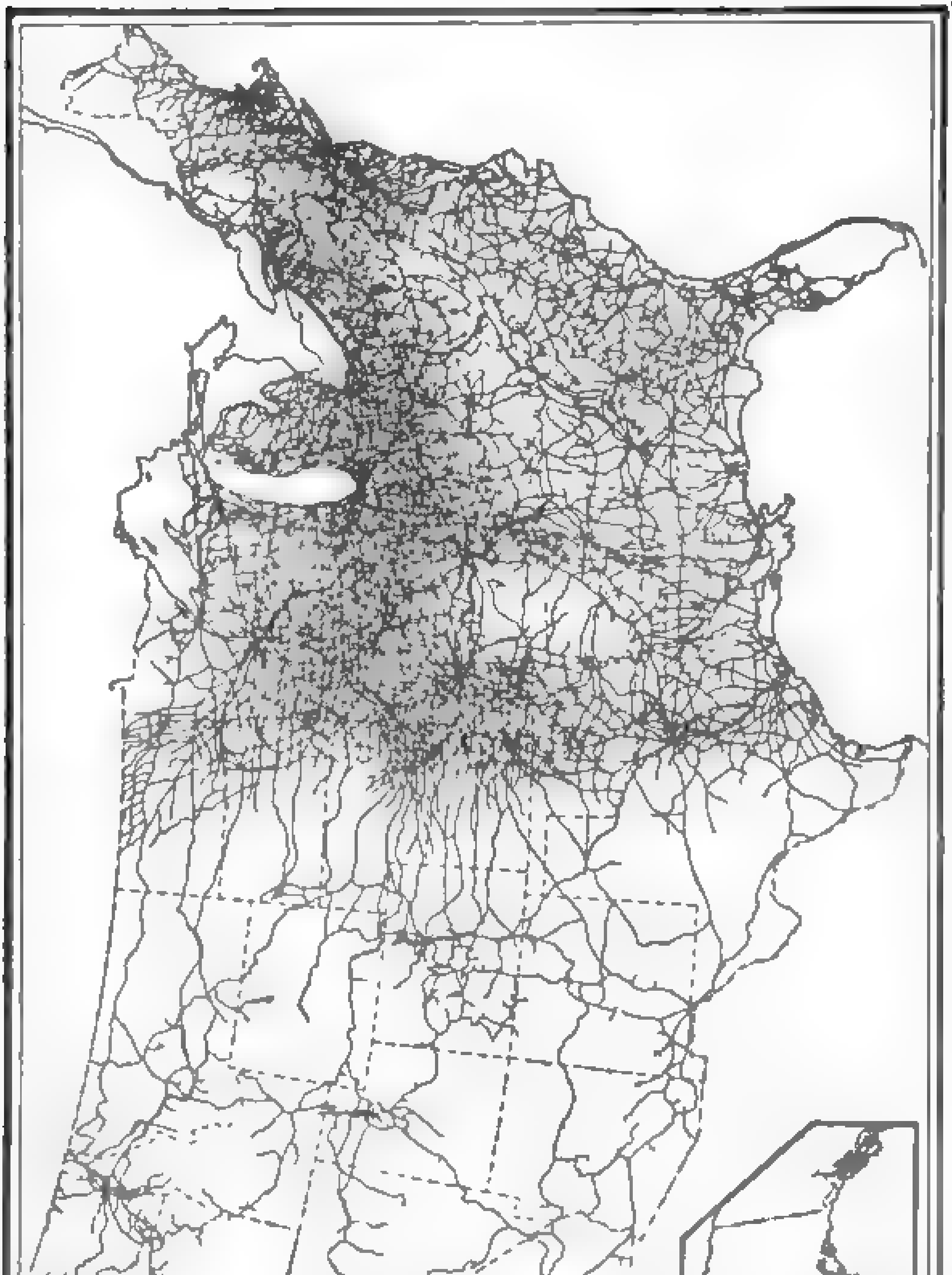


Fig. 216.—The railroads of the United States in 1911.

ur waterways, of which President Roosevelt in a message to ongress said: "Our river systems are better adapted to the needs f the people than those of any other country. In extent, disribution, navigability, and ease of use they stand first. Yet he rivers of no other civilized country are so poorly developed, o little used, or play so small a part in the industrial life of the ation as those of the United States. In view of the use made of ivers elsewhere, the failure to use our own is astonishing, and no houghtful man can believe that it will last." These resources onsist in 25,000 miles of river now used to some extent; 25,000 niles that might be improved; 2,500 miles of canals and 2,500 niles of bays and sounds that need connecting by canals. The vaterways have languished and the railroads have thriven because ve have been an individualistic rather than a social people. The ndividual or corporation could make a fortune from a railroad, vhile the river, free to all, merely interfered with the monopoly f the railroad interests and favored the shipper rather than the arrier. The most conspicuous exception to this is the Great akes, a utilized waterway upon which, however, the railway ompanies run many boats which merely become extensions of he railroads. Before the coming of railroads, this country, like nany others, was dependent upon rivers to an extent now little nown. Thus the Ohio and Mississippi rivers were the first reat avenues of trade, travel and settlement in the country west f the Alleghanies, which they dominated till 1850. But these treams were not improved and the Great Lakes were, and they ave dominated the commerce of the last half of the nineteenth entury as the Mississippi had dominated the first half.

Influence of the Great Lakes in Making Routes.—The primary outes of the continent are those connecting the continental nterior, the upper Mississippi Valley and the Great Lake Basin, vith the Atlantic. Curiously enough, the main thoroughfare o this region is not by way of the St. Lawrence with its great stuary, nor by the navigable Mississippi, but through the low lain connecting the Hudson Valley and Lake Ontario. The alls of Niagara, together with the rapids and ice of the St. awrence, hindered the early development of that route. A urther drawback was the political division of the St. Lawrence alley between two countries; another was the occupation of the

lower part by the less numerous population and the one having the smaller interest in the West. The Gulf of Mexico appears to be the natural outlet for much of this region, but settlement began in the north and went west building routes as it went; so over these lines of travel went the trade to the Atlantic cities and Europe. The white population of the Lake Basin and adjacent territory moved in by many routes, but the best way to get goods back was by the route along the Hudson and Mohawk rivers, which flow out through the only complete break to be found in the Appalachians between Maine and Alabama. The completion of wagon roads across the state of New York about the beginning of the century was followed by the building of the Erie Canal in 1825, the first extensive canal in the United States. The tapping of the lakes by this canal was revolutionary for the commerce of the West. The fact that the St. Lawrence drained the waters of the lakes was now of no avail. The Erie Canal drained their commerce into the Hudson and it made commerce. A barrel of flour, which before this had consumed its profit in paying wagon freight for a hundred miles, could now be taken from the lakes to the sea for a tiny fraction of the former prohibitive freight. A large territory in the heart of the continent was given commercial possibilities, because the new route made possible a commerce with Europe by way of New York. New Orleans had a handicap of a distance 50 per cent greater, and the growth of population and trade in the canal period was naturally most rapid in the territory affected by the Erie Canal. The early dominance of the navigable Mississippi in the economic life of the nation is shown by any population map of the period. In 1846 the commerce of the Lakes was $64,000,000, but that of the western rivers was $183,000,000. But this leadership of the rivers went down before the advance of railroads which have cooperated with the Lake carriers but not with the river carriers. The building of railroads to the West was most easily accomplished along the open route followed by the Erie Canal. This, too, was a profitable place for the building of a railroad, because here were already in existence the traffic-breeding centers of population that had grown up in the territory enriched by the canal that had made cities in the wilderness.

The Great Lakes thus have dominated the development of

trade routes in the railway era. Along these shores are the greatest interior populations and trade. The lake freight rates, which have been but a fraction of land rates, were a freight attraction that gave any lake port access to a vast inland territory. The lake shores have, therefore, always been magnets to the railway builders. Whenever possible these men have brought their lines to the lakes at some point or points so that they might forward

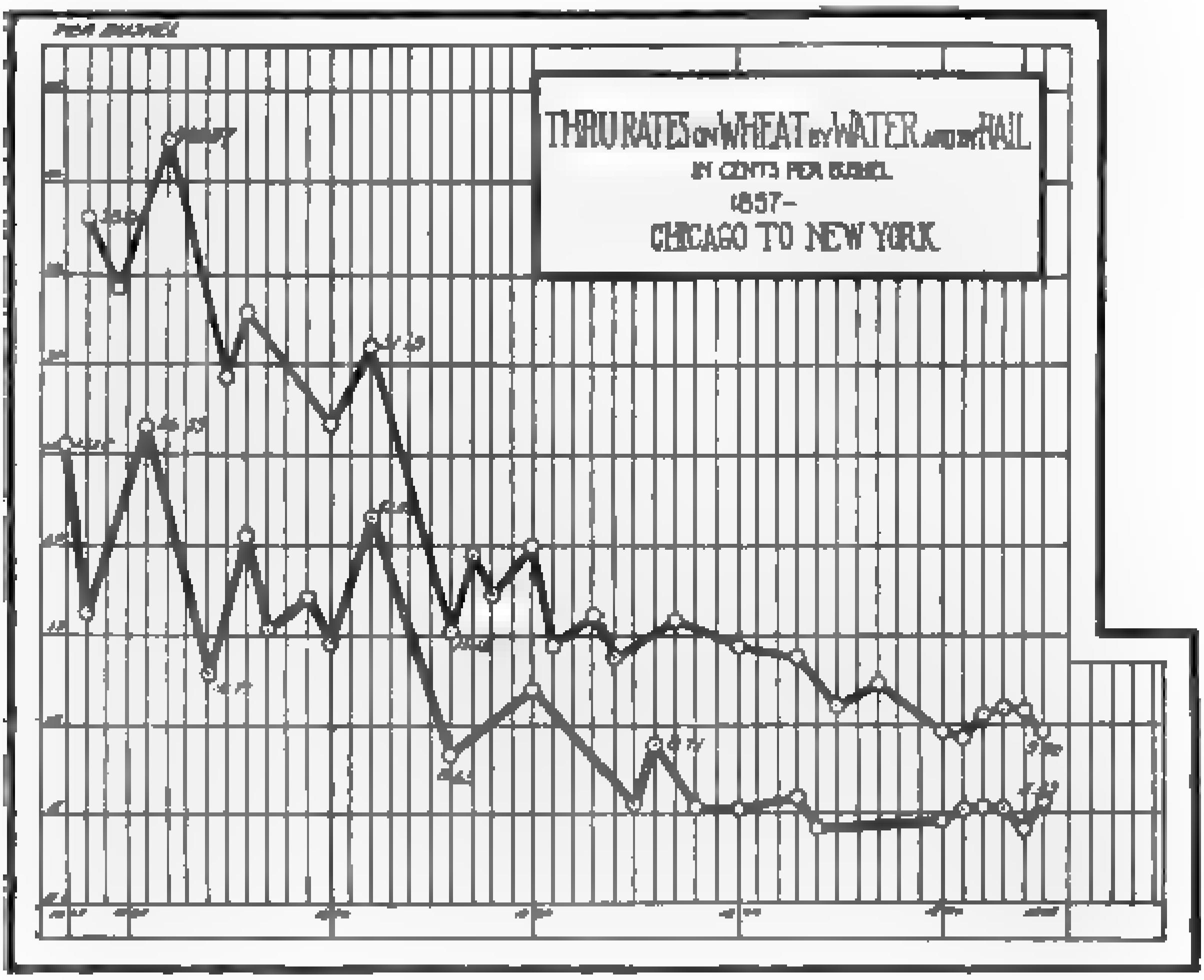


Fig. 216.—Water transportation is a controller of railway freight rates. (After J. Paul Goode.)

to the eastward by boat and get a share of the water-borne lake traffic, going west. Consequently the Great Lakes have been the deciding factor in locating one terminus of most of the railroads of the central West. The trade routes of this region may now be likened to a section of a thick cable woven of many strands which are untwisted and spread out fan-like at both ends. The lakes, with their steamship lines and the competing and auxiliary railways that follow their shores, make the central or compact

section of the cable. The loose ends are represented by the many lines of railway that converge at the western lake ports, and by the other lines that diverge from the eastern lake ports to the Atlantic coast.

Western Assemblers of Lake Traffic.—The ports of northern Lake Superior may at any time receive the freights from three trans-continental railways—The Canadian Pacific, the Great Northern, and the Northern Pacific. The Grand Trunk Pacific is also practically in this class, for while not yet completed to the Pacific, it is a mighty carrier in the country beyond the Lakes. Milwaukee, on the west side of Lake Michigan, has lines running westward and northwestward, connecting with these trans-continental lines. Chicago, the greatest railroad center in the world, at the southwestern corner of the Great Lake system, is connected with all trans-continental lines, even those that touch the Canadian and the Mexican boundaries. Toledo, at the western end of Lake Erie, is a Chicago on a smaller scale, a center for many shorter railway lines. Cleveland, on the southern shore of the lake, is a more important center, having eight different railways.

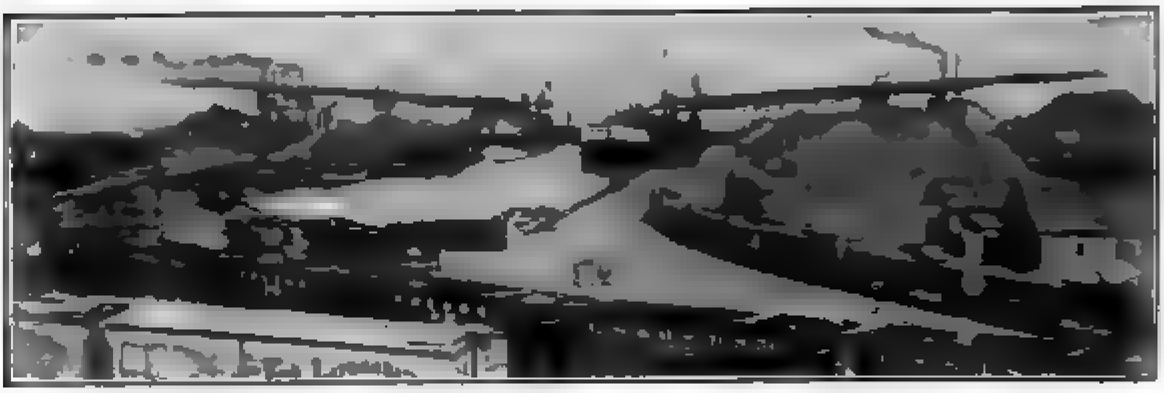


Fig. 217.—Iron-ore dock, steamer, railroad terminal and ore storage at a Lake Erie port.

Once the railways have brought their grain, lumber, and ore to the lake ports, water transportation renders a great service. From Duluth, Port Arthur, and Fort William on Lake Superior, and from Milwaukee, Chicago, and Toledo a vast fleet of steamers and barges busily and cheaply carry freight to and from Cleveland, Buffalo, and even Montreal on the east. But the railroads are also busy with the east and west traffic. North of the lakes,

etween the lakes and with many lines south of the lakes they eep up a constant competition with the lake vessels, and, in he winter months when the lakes are frozen, they must carry ll the freight. The railroads also get at all seasons the vast mount of high-class freight for which there is need of haste. Thus, meat, one of the greatest, if not the greatest single product n value in the whole Lake basin goes eastward chiefly by rail rom the great packing centers of Chicago, Kansas City, Omaha, nd Sioux City. The grain from these same markets gravitates oward the Lake steamer.

FIG. 218.—Dumping carload of coal into steamer on Great Lakes.

The Traffic of the Lake Region.—In numbers of tons per year he traffic through the American and Canadian canals around he rapids at the eastern end of Lake Superior, far out-ranks that assing through the Suez Canal. The tonnage of freight passing Detroit is as great as the combined foreign trade of New York, ondon, and Liverpool, although it is of far less value per ton.[1] The enormous shipments of iron ore are the largest single item. umber, coal, and grain also assume great proportions.

Millions of tons of coal are carried from the southern shores of

[1] The Welland Canal at the other end of the Lake shows with its small onnage of 3 million tons per year the limiting influence of shallow draught.

Lake Erie to the upper lakes at a freight rate of thirty cents per ton. The ore rate is commonly sixty-five cents from Duluth to

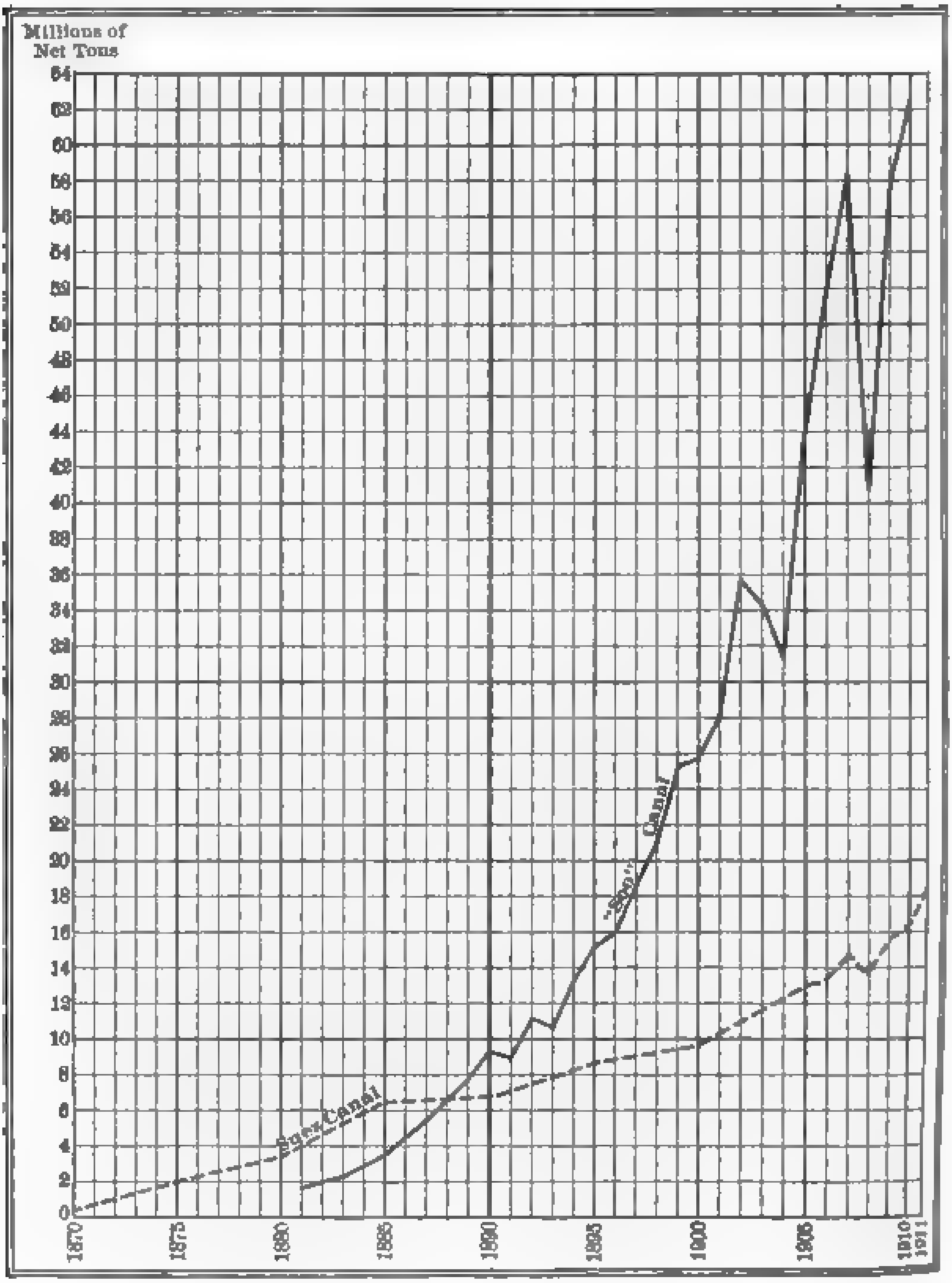


FIG. 219.—Canal Tonnage at Suez and the "Soo."

Ashtabula, near Cleveland and grain is carried nearly 900 miles from Chicago to Buffalo for forty-one cents per ton.

The lower rate westward is due to the competition of the many vessels for the relatively small return freight. In 1907 80 per cent of the traffic through the Sault St. Marie Canal was eastbound. Important articles in this total of 51.7 million tons were iron ore 35.3 million tons, wheat 84 million bushels, other grain 54 million bushels, flour 6.5 million barrels, copper 107,000 tons. Westbound 7.7 million tons bituminous coal and 1 million anthracite.

The lake steamers are a highly specialized type. They are just as deep as the builders dare make them to pass through the 21-foot channels that have been dredged in the shoals between lakes. The deepening of these passages by the United States government has aided the ship-builder in a rapid increase in the size of the boats. In twenty-five years the capacity of the largest has gone from 3,000 to 12,000 tons and those holding 10,000 tons now number nearly 120.

The vessels are built with many hatches for fast loading in which gravity is the chief factor. In unloading the bulk cargoes especially of ore or coal, clam shell grab buckets, some of them of 15 tons capacity reach into the bottom of the ship and grasp minerals as human hands would scoop up sugar. Ten thousand tons of ore have been loaded in thirty-nine minutes and 10,000 tons of coal unloaded at Duluth in fifteen hours. These factors of economy explain why the Lakes draw the traffic.

Eastern Distributors—Canadian Group.—From the Lake basin to the Atlantic there are many routes to tide water between the Gulf of St. Lawrence and the Chesapeake Bay. On the north the St. Lawrence with the port of Montreal offers an economical route now that 14-foot boats can pass through the Welland Canal around Niagara Falls. Montreal is also fed by the Canadian Pacific Railway running north of Lake Superior and having a branch running to the south of that Lake, by the Grand Trunk line from Chicago, Detroit, and Toronto, and by a special lake outlet railway from Parry Sound on Georgian Bay, an arm of Lake Huron. The Canadian Pacific is now building a new freight line almost without curves or grades from Victoria Harbor, Georgian Bay to Montreal and it is sixty-five miles shorter than the line from Buffalo to New York. In 1910, of the 51 million bushels of grain that passed through the Canadian Canal

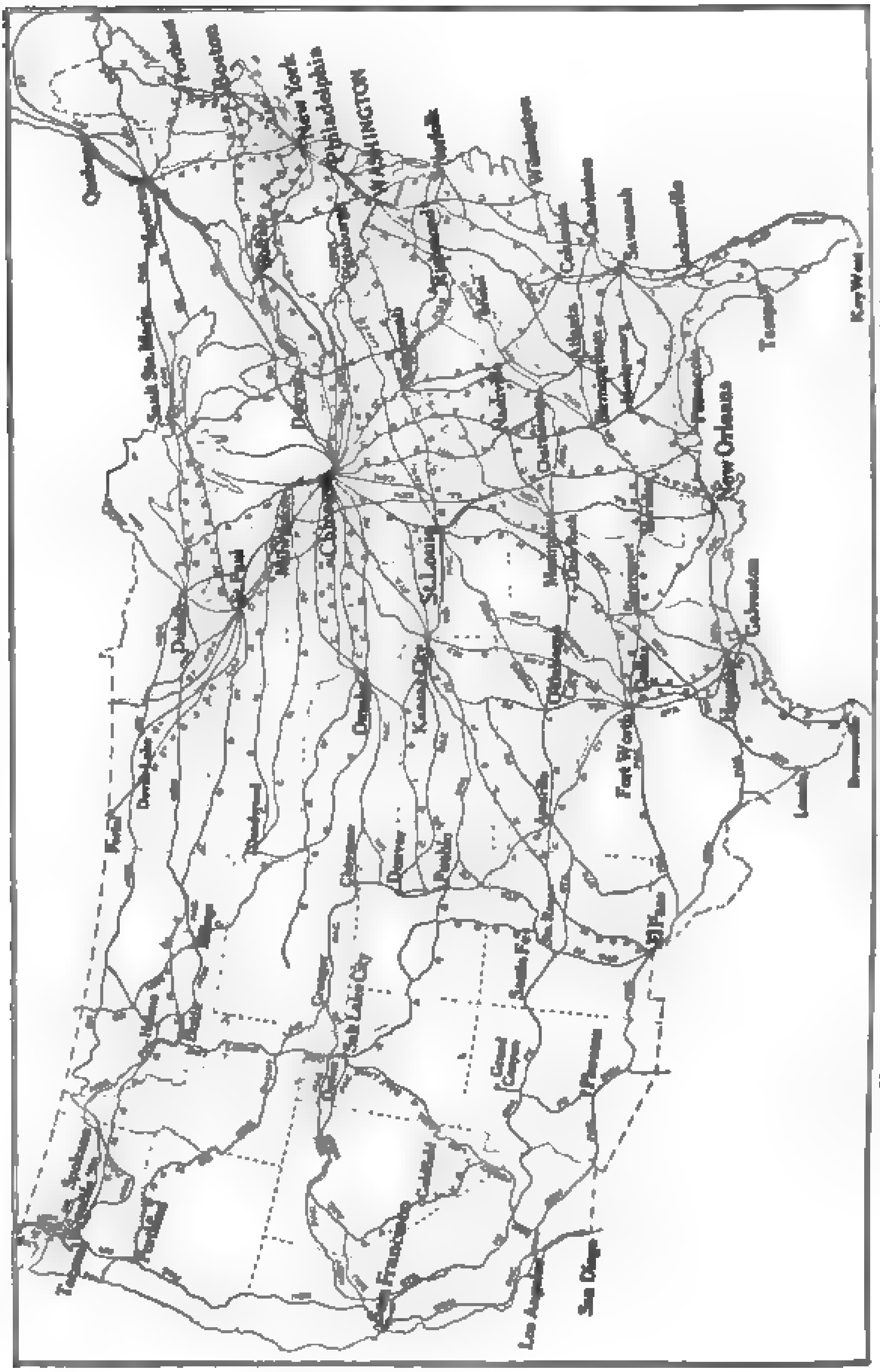


Fig. 220.—Map showing leading trunk railroad lines in the United States

at Sault St. Marie, 25 per cent. went by boat to Montreal, 30 per cent. via Buffalo and United States ports and the remainder by rail from Canadian ports west of Lake Erie and thence down the St. Lawrence (to understand Canadian transport problems consult a globe). Unfortunately for the St. Lawrence route (400 miles shorter than via New York) the river is closed by ice from Dec. 1 to May 1. Thus two railroad bridges cross this river at Montreal to give the Grand Trunk and other railways an outlet at Atlantic ports, chiefly Boston, Halifax, St. John, N. B., and Portland, Me., the latter cities being the chief winter ports for the Montreal steamer lines. During this season St. John has twelve steamer lines.

Eastern Distributors—American Group.—Buffalo, on the eastern end of Lake Erie, is the greatest distributing point for the traffic passing from the Lake basin to the East. Vessels of 14 feet only can pass from Lake Erie to Lake Ontario, but Buffalo can be reached from any of the four upper lakes by vessels of 20-foot draft, and with a carrying capacity that exceeds the average reached by the carriers on the ocean itself. Eastward from Buffalo traffic is divided between the Erie Canal and a dozen railroad tracks. At Albany and Troy some of the traffic is diverted from the Hudson route and taken directly eastward to Boston by the Boston & Albany and Boston & Maine railroads. Between Buffalo and New York, two railways, the Erie and Lehigh Valley, follow the more direct but more difficult course across the mountains of northern Pennsylvania where they are enabled to take advantage of the anthracite coal traffic. This multiplicity of roads from Buffalo has been steadily increasing in efficiency, adding new tracks and cutting into the proportion of traffic carried by the now rather antiquated canal. The vast canal improvements now being carried forward by the State of New York will, however, restore the historic waterway to an enlarged share of the now greatly augmented traffic.

The Railways from the Lower Lakes.—To the southward of the Buffalo routes, the Lake basin has three other outlets to the Atlantic—the Pennsylvania Railroad, the Baltimore & Ohio, and the Chesapeake & Ohio. The first two of these routes come directly from the Lakes at Chicago, Cleveland and other

Lake Erie points; and across the Alleghenies, the Pennsylvania between Pittsburg and Philadelphia, the Baltimore & Ohio through West Virginia to the headwaters of the Potomac. Both roads reach the three ports of New York, Philadelphia, and Baltimore, but New York is the chief port for the Pennsylvania, and Baltimore for the Baltimore & Ohio. The Pennsylvania railroad is often said to have the best location in America because it connects Chicago, Pittsburg, Philadelphia, and New York, has a great number of branches tapping the agricultural and manufacturing region between Chicago and Pittsburg, the coal, iron, and oil regions of western Pennsylvania, the manufacturing towns of eastern Pennsylvania, and because it finally reaches the great manufacturing city, Philadelphia, and the greatest port, New York. South of the Baltimore & Ohio, the Chesapeake & Ohio and the Norfolk & Western pass through southern West Virginia and the Valley of the James from Cincinnati to Norfolk and Newport News. Although these routes have connections with railroads to the Lakes, they are more especially the outlet of the Ohio Valley, a service that is equally valuable to the more efficient and double-tracked Pennsylvania and to the Baltimore & Ohio. The extension of the Wabash system from the Ohio River to Baltimore adds another through line to this group. This new line will run close to the Baltimore & Ohio, being south of it in the Alleghenies and north of it in the Atlantic Plain.

This rather surprising number of routes to and from the Great Lakes is due to the remarkable topography of the basin of this group of lakes. They lie at the very top of the continental mid region, *upon its very roof*, a reservoir and water transport system on a level plateau. By the digging of a mere canal at Chicago the waters are diverted to the Mississippi. The four southern lakes are so nearly on a level with the general surface of the country, that they can be approached by railway at almost any point suitable or desirable for the landing of vessels. Hence, the multiplicity of routes to them and from them.

Between the Chesapeake Bay and the Gulf there are no railroads of the first magnitude going inland from the Atlantic because there is no inducement to take export goods across the mountains to this corner of the continent. The region of the lower Ohio has sufficient natural outlets toward the Chesapeake,

e Lakes, or the Gulf. Charleston, Savannah, and the lesser ıth Atlantic ports are fed by the local railways and the vigable rivers in the Atlantic plain. This limitation of ınsport facilities gives them a prospect of permanently small e in comparison to that attained by ports having good conction with the center of the country.

The Side Doors of the Continent.—This great sheaf of east d west routes bound together by the Great Lakes, and reaching o the center of the continent, has really grasped more territory ın it can hold. As the result of transitory rather than perınent conditions of settlement, it has, in grasping for the als of the continent, overreached and placed itself in unstable ıilibrium by taking trade that can, with the improvement routes, go more easily by the side doors to the south and to north—the Gulf of Mexico and Hudson Bay.

The Mississippi Valley with its natural outlet toward the ılf has created, first, New Orleans on the great river near its uth, then at the sides of the valley, Galveston, Mobile, and nsacola, which have become important with the building of railways from the productive districts to the northward. ıese are all cities of the second class, but they are all at the d of promising lines of trade to the upper valley. Each also s a rich local territory in the cotton belt, Mobile has in addin, Alabama iron and coal, and Galveston can command Texas, lahoma, and Kansas grain. Although the routes to the Gulf rts at present are drawing but little freight from beyond the ıio and Missouri Rivers, in the course of the coming decades ese routes will be extended to the North, and perform a more portant part in our foreign trade. As the population and lustries of the United States grow more like those of Europe commerce of the Central States will be relatively less with ırope and more with the tropics. The opening of the Panama ınal will be another strong factor helping to change the comrcial front of the Mississippi Valley from the Atlantic to the ılf. The lower Mississippi Valley, with vast undeveloped ources, also has great industrial changes before it, so that it is ssible that by 1950 the Gulf routes will equal or excel in comrcial importance those that connect the Great Lakes and the ıio with the north Atlantic. These predictions are by no

means dependent upon pure speculation. These changes are already in evidence and are progressing rapidly. The center of export grain production is, through our growing eastern population, going farther and farther to the west. The center of manufacturing is following. The congestion of the eastern railroads has recently resulted in the establishment of freight differentials greatly in favor of the Gulf roads. These roads are prospering with the increased traffic, and are making great and successful efforts to develop a north and south trade at the expense of the east and west trade. Nature is with them.

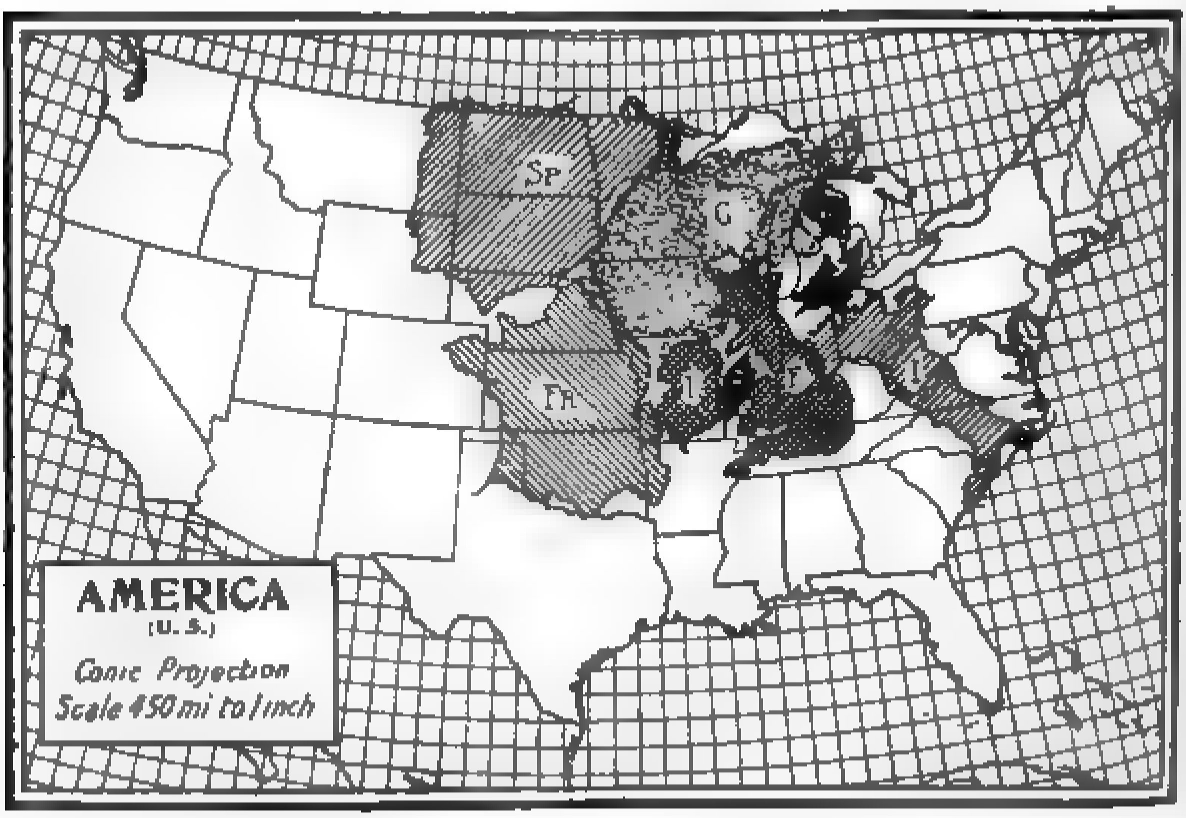


FIG. 221.—Dr. J. Paul Goode's graphic method of showing the commercial possibilities of Chicago.

This should not be interpreted into any prediction of decline for the eastern roads. Under present normal conditions they are and must be congested, crowded, overburdened with a prosperity that arises from the great growth of commerce which has come to stay. New trade will go to the Gulf. In the period 1884–88 the wheat export of the Atlantic states was 45 million bushels a year and that of the Gulf was 2 million. In the next five-year period the Atlantic report rose to 60 million but the advancing Mississippi Valley sent 29 million bushels from the Gulf ports, since that date our advancing population has by its

home demand cut off most of the wheat export of the United States and the plains to the northward in Canada have risen in prominence.

The completeness with which Chicago has been surpassed as a wheat market is shown by the receipts at various markets for the year ending Aug. 31, 1910.

City	Bushels	City	Bushels
Winnipeg	88,269,330	New York	23,304,300
Minneapolis	81,111,410	St. Louis	21,432,317
Buffalo	61,084,797	Philadelphia	10,331,854
Duluth	56,084,971	Omaha	9,979,200
Kansas City	35,354,000	Milwaukee	8,871,026
Montreal	30,081,779	Baltimore	5,821,809
Chicago	26,985,112	Cleveland	4,874,871

This production of vast exports far beyond the western end of Lake Superior has presented a problem for transportation and has caused much hope of a new route.

To Europe by Hudson Bay.—The wheat-growing districts of the new Canadian Northwest are nearer to the shores of the Hudson Bay than they are to Lake Superior; and Hudson Bay in turn is, owing to the short degrees of high latitude, much nearer Europe than the maps show. Fort Churchill, on the western shore of Hudson Bay, near the mouth of Nelson River, is 100 or 200 miles nearer to Liverpool than New York is and 1,400 miles nearer than New Orleans. The Hudson Bay route's advantage of distance is modified by the winter ice, which closes the passage to the Atlantic for the greater part of the year, and may possibly prevent any extensive use of the route. This likelihood, however, declines with the report of every returning exploring party; and many Canadians now confidently expect this route to be the chief outlet of their expanding northwest. Within a period of two years five railroads were chartered to go to this northern sea, one of them a branch of the Great Northern, an American Continental line. In the time of getting product in market, the Hudson Bay route does not differ so greatly from the Great Lake route. The closing of Lake Superior by ice takes place so

early that only 20 per cent of the wheat of west Canada is exported the year it is grown. Heavy midsummer grain export may, therefore, be expected if the Hudson Bay route is equipped with rails and warehouses, and steamers find ways to thread the great abundance of Arctic icebergs that will beset their path till east of Greenland.

The Trans-Continental Lines.—Between the Pacific coast and the more populous East lie the Great Basin, the Rocky Mountain plateau, and the Great Plains, now crossed from east to west by seven railways, commonly known as the "Trans-Continental Lines," although, with one exception, the routes lose their identity at the middle of the Mississippi Valley, which may really be considered their eastern end. They here serve as feeders to the eastern routes described above, which forward the freight from any and all of them to the Atlantic coast points. If the Oregon Short Line and the San Pedro, Los Angeles, and Salt Lake Line are included, there are eight distinct ways of crossing the continent; and more are building. In the competition for the trans-continental trade, the northern and southern routes are more favorably located than the central; and the most southerly route, the Southern Pacific, has, in some respects, the best location of all, and in other respects the worst. This route, having its termini at San Francisco and San Diego in the west, and at Galveston and New Orleans in the east, has the shortest land carriage, but it has the disadvantage of crossing the most arid part of the United States. From Galveston and New Orleans the route is in reality continued to New York by a regular line of steamers operated by the same company. This combination of railways and steamship route secures much California trade with the East. The three northern routes, Canadian Pacific, Great Northern, and Northern Pacific, with their termini on Lake Superior, utilize the cheap water transportation of the lakes and operate steamers to Buffalo, and have regular traffic arrangements with the railways from that point eastward. The northern routes are also shorter than the lines that cross the central or widest parts of the United States. The Great Northern has the easiest route of all in that it crosses the Rocky Mountains at their narrowest and lowest part. The development of railroads in the Trans-Missouri country has gone forward

with a speed that amazes even the onlookers. No generation has ever anticipated what the next decade would bring to pass in this region. Proof of this is furnished by the statistics of trade and by the history of the industrial development in the Trans-Missouri region. The California gold discoveries first fixed American attention on the problem of crossing the plains. The first regular transportation service across the Great Plains was the "Pony Express," small packets of letters and valuables carried by relays of galloping horsemen. This was succeeded soon after the gold discoveries of California by wagon trains that set out from St. Louis, Kansas City, and Omaha for New Mexico, Utah, and California. The first of the railways was the Central and Union Pacific, opened in 1869 from Omaha to Ogden and San Francisco. This was a government enterprise built for the trans-continental trade. It was greatly needed to unite the widely separated East and West and was partly paid for by Government money, as people with private capital were unwilling to make the venture, predictions of failure being heard on every side. Within seven years Colorado, with its mining camps a thousand miles beyond Chicago in the region served by this new railway, had been settled, organized as a territory and admitted as a state. This state, with its quick prosperity, depended entirely upon the Union Pacific to connect it with the world markets, and was more important to the road than was California with its sea outlet. The number and striking appearance of the trans-continental railways, when shown upon a map, tend to give an exaggerated impression of the part that they play as through carriers of freight. The strictly trans-continental traffic, aside from passengers and mail, is not large.[1] The chief service of these routes is as carriers of the freight produced along the lines, or of coast traffic consigned to interior points. This mid-continental traffic, combined with the prosperity of the Pacific Coast, has given an impetus to trans-continental railway building that has resulted in seven or eight completed lines within forty years, with others now in contemplation or under

[1] The prohibitively high cost is shown by the wheat rate of thirty-five cents per 100 pounds from Logan, Montana (111° W.) the traffic divide on the Northern Pacific to the Pacific or to Duluth (1,055 miles). Either terminus of this road is thousands of miles from the price-setting market at London.

ıs not developed into a port of prominence nor has San the port of the populous and prosperous Los Angeles district. northwest the chief productive regions (aside from lumber- e the Columbia and Willamette valleys, which also furnish for railways to the port of Portland. The Columbia is avigable to the eastern boundary of the State of Washing- ut the great excellence of Puget Sound for the development at harbors and ports, combined with the richness of its liately adjacent territory, and the shorter route to a rich r, marks it as the site of the coming commercial metropolis Pacific coast of all America. In 1911 the vessels engaged in ı trade, and entering Puget Sound ports, had a tonnage of million, while those entering San Francisco amounted to an one million tons.

ween southern British Columbia and the Yukon Valley is a ainous region with unclimbed peaks and valleys unthreaded rld or local commerce. In latitude 54° 20′ near the south- int of Alaska the Skeena River flows from a defile in this ain mass. This sharp valley has been selected as the site ie Canadian trans-continental road—the Grand Trunk which plans to connect the surprisingly warm wheat of northwest Canada with the Pacific and make a world f the little settlement called Prince Rupert. Beyond this, almost frozen Alaska, the arctic interior of the continent en invaded by a modernized trade route, and the dog sledge e human pack carrier have been succeeded on the main line le by the railway and the steamboat. The Klondike gold lying upon the upper Yukon on both sides of the Alaska- ian boundary were at first reached by the trail over the ains near the coast, and in summer by the steamers upon ıkon. But the gold fields are far from the mouth of the which is open only in the summer months and must be l from St. Michaels, across a part of the Behring Sea. iver route to the Klondike is hundreds of miles longer than ore direct one over the mountain ranges that separate the Yukon from the Pacific. This overland route, at first a trail, has been used since the discovery of the Klondike and within two years after the important gold discovery the railway, beginning at the harbor of Skagway, had

crossed the mountain pass and connected the steamer c Fiord coast of south Alaska with the brave stern-wheele risks the shifting sands of the Yukon. Other lines ar building to reach the middle Yukon from the center (south coast of Alaska.

Seattle and, to a lesser extent, Tacoma and San Fra are the chief trade bases for the vessels, mostly the steam two companies which carry almost the entire trade of A Alaska sends gold, fish (mostly salmon) and fur in exchan the great list of foods, clothing, and supplies needed by men in a cold land, not suited to agriculture.

The Routes of Mexico.—The trade routes of Mexico are, in a continuation of those of the southwestern part of the U States. The great majority of the Mexican people live up plateau enclosed by the eastern and western Cordilleras that parallel the two coasts until they meet a short distance so the city of Mexico. Three railway lines from the United enter this plateau by the easy northern ascent. Three othe climb the steep escarpment from the Gulf coast. The no routes carry an active overland trade with New Orlean Louis, Kansas City, and Chicago; but a larger and more val trade goes to the Atlantic ports of United States and Euro steamers from Vera Cruz and Tampico.

There is an isolated railway system on the flat plains of tan. Three small lines, converging at Progreso, serve to c the Yucatan sisal crop for shipment from that port.

The Pacific coast of Mexico is inadequately supplied trade routes. The trade of that region is naturally wit Atlantic, from which it is profoundly barred. The isolation coast from world routes discouraged the building of railwa or from the interior, because the Pacific is not the sea of Me commerce, then Nature barred this isolate coast from the int The western Cordillera is high and abrupt, making railroad l ing difficult. A number of lines have been projected, bu first one completed was in 1902 when the trains first crept from Guanajuato on the plateau, to Manzanillo, at the coast. Since that time an American company, the Kansas Mexico, & Orient has started to build a line from Kansas to Topolobampo, a port near the lower end of the Gulf of

fornia. This line has been begun at several places and it is completed from the coast across the mountains to the plateau lines of railroad.

About twenty years ago a branch of the Southern Pacific was extended from Nogales, on the Arizona boundary, to Guaymas, a port on the Gulf of California; and it has recently been extended southward nearly to the latitude of the city of Mexico. The Pacific coast is a promising region for tropic and sub-tropic agriculture, and the mountains of western Mexico are rich in minerals. The opening of the Panama Canal will give this region a short route to the Altantic and will stimulate the building of railways in western Mexico. At present there are only mule trails reaching from 100 to 200 miles inland from a number of ports.

Mexico has, in the Tehuantepec Railway, a most efficient trans-continental line. This road connects Coatzacoalcos, renamed Puerto Mexico, on the Gulf, with Tehuantepec, renamed Salina Cruz, on the Pacific. This road was built by the Mexican government on one of the routes once cherished as site for an Isthmian Canal. The road is leased to an English company and has been put in good order and the termini improved for the transfer of freight from ocean to ocean. The line of American steamers that had for eight years (1899–1907) been rounding South America at once turned to this route and the traffic capacity of the single-track railway was reached within a few months after the formal opening. In a recent year 359,000 tons of freight moved eastward and 277,000 moved westward over this line. The time required for the delivery of freight from New York to San Francisco is now thirty days, and a reduction to twenty-five is promised. The delays of a congested trans-continental railway compare very unfavorably with this. Six to ten days are commonly required for short railway freight shipments in the eastern United States. When the Panama Canal is completed there will be a strong competition, and it is likely that the through traffic of the Tehuantepec Railway will be of smaller extent if it survives for any but Mexican traffic. The local traffic of this road is now increasing, owing to the many new coffee and rubber plantations along the line.

The Central American Routes.—With the possible exception of western Mexico, Central America is the most unfavorable

continental divide. It so happens that this plateau
nearer the Pacific than the Atlantic; some of it was sett
that ocean, and at the end of the nineteenth century
capitals of Central America, with one exception, h
connection with the outside world by way of the P
spite of the isolation of that coast. This isolation
greatly modified by the steamers that since 1848 ha
between Panama and San Francisco. San Jose, th
of Costa Rica, was the one Central American capital
transferred its commercial allegiance from the Pacifi
Caribbean upon the completion of a railway to the e
at Port Limon. Guatemala city, which has for years
road connection with the Pacific, has recently been reac
Caribbean railroad. Of the other capitals, two have
to the ocean; San Salvador to La Libertad, and Mana
capital of Nicaragua, is on the railroad connecting Gr
Lake Nicaragua with Corinto on the Pacific. Teguci
Honduras, has only a cartroad from Fonseco Bay
Pacific. Central Nicaragua also has a partial outlet to
by the steamers, which at some seasons navigate the
River from Lake Nicaragua to the sea at Greytown
Central American railways are in contemplation or
among them the Costa Rica Railway, which has for ma
been nearly completed to the Pacific coast near Punt
in the Gulf of Nicoya. In considering the Central

Pacific and the consequent commercial readjustments will affect most of the trade routes of the continent. The changes in traffic movement, however, will not be so much in traffic actually diverted from one route to another as in new traffic that will result from increasing industry. The routes from the northern Mississippi Valley eastward will decline in relative importance, while those to the Gulf increase. The routes from the continental divide westward will be stimulated by the increase of local traffic that must be called into existence by a cheaper ocean rate to the Atlantic. This will be quite as true in Central America and Mexico as in Canada and the United States. The same force that increases the traffic of existing railways from the Pacific coast to near-by points will cause the construction of many other lines, furnishing routes for traffic that does not yet exist.

These advantages of the canal to the railroads will develop with the passage of time, but the immediate result will be the loss of some through trade by the trans-continental lines. This loss will be heaviest on the southern lines, which are in most direct competition with the canal route and which, running through a more barren territory, have had a greater dependence on trans-continental traffic than the northern lines have had.

Waterway Improvement in United States.—The United States needs more facilities for transport, as shown by the freight congestions that clog our railroads in times of exceptional prosperity. The increasing land values that accompany our increasing population make railroad building increasingly costly. The experience of Europe has clearly shown the advantage of extensive expenditures on canals and river improvement, and there is a growing sentiment in the United States in favor of the improvement of our waterways. At present they are in an astonishing state of neglect. The Mississippi River is one of the finest natural waterways ever possessed by any people. It is 1,156 miles from New Orleans to St. Louis and thence 697 miles to Minneapolis and 406 to Kansas City. There is no steamboat line running the whole length of the stream, and except for coal barges and rafts it is very largely neglected at a time when we need new facilities and it is known that railway transportation is several times as costly as water transport. St. Louis, served

by twenty-four railroads, and receiving 3 million loaded cars per year, and Kansas City, served by thirty-nine railroads, are connected by 406 miles of navigable river which for years was entirely unused. Sign of revival is seen in a one-boat service in 1911, and a four-boat service in 1912.

The waterways can only become effective when effort is made to have through routing of freight and this the railroad companies have usually refused to do as a part of their diligent policy of thwarting the development of water transportation. Another element of success with waterways is the necessity of uniform and far-reaching system in the construction of locks and the maintenance of depths. The pork barrel system of waterway legislation so prevalent in the United States has put locks of varying sizes on the same stream, made a stretch of good navigation here and there that connected with nothing and leaves us such monuments as the canal at Mussel Shoals on the Tennessee River. In 1908, 12,000 tons of freight passed through it at a cost to the government of $4 per ton for repairs and maintenance and $7.50 per ton for interest (at only 3 per cent) on the cost of the installation. Granted systematic construction and compulsory through routing of freight by the railroads, the waterways of the United States have a busy future. The possibilities of the Mississippi River are enormous. At the head of its navigable branch, the Ohio, is Pittsburg, the capital of coal, iron, and glass with the astonishing traffic of 150 million tons[1] a year. The Chicago Drainage Canal gives connection with the Great Lakes and the Mississippi itself flows through the heart of the corn, oat, meat, and hay belts and reaches at Minneapolis the edge of the winter wheat country and the greatest flour-milling center in the world. The continued neglect of such a waterway is an almost inexplicable waste of resource. We need less triple tracking of coal, wood, and iron-wasting railroads and more construction of resource-saving waterways for which the geographic conditions of the country are so favorable.

[1] These figures become more significant when it is remembered that the United States has never yet produced 4 million tons of cotton or 24 million tons of wheat in one year. The total world export of wheat is less than 20 million tons (1911) and the entire world's crop of wheat is about 100 million tons a year.

CHAPTER IV

THE TRADE ROUTES OF EUROPE

Phenomenal Natural Advantages.—European land forms 'eatly favor commerce. The forces that build continents ere, in the matter of trade routes, kinder to Europe than to ıy other of the great divisions of the world. Irregular coast ıes make short and easy communications between the interior ıd the sea, the cheapest of all highways. No other continent ıuals Europe in this respect. Africa and South America resem-e solid blocks; and even the United States, with its favorable cation, its splendid routes, and an area nearly equal to that of urope, has but 5,200 miles of sea coast, while Europe has),000. Hence, it is natural that the greatest trade routes of urope should be water routes, and that its railway mileage ıould be relatively low.

Trade is further favored by the location of the inland seas that dent the European coast. In the north, as in the south, a ıccession of seas penetrates to the very center of the continent. he only comparison would be the American Great Lakes if ey were navigable at all times by ocean vessels. The Black a extends the advantage of the great ocean 50° eastward from estern Spain, and the Baltic is almost equally favorable for ırthern Europe. Between these northern and southern seas, ırope is but a great peninsula, fringed with a succession of ıaller peninsulas, each having the particular commercial ad-ntages of such a position. For commercially advantageous cation, Greece, Italy, Iberia, Scandinavia and Denmark fall ıt little below so many islands. France faces two seas, Russia ree, and Great Britain is an island kingdom. Further than this, ırope possesses no large isolated plateaus, and it is well supplied th navigable rivers. The pronounced climatic and economic fferences between the different sections of Europe have been a rther basis for the development of a large trade between the ıropean countries.

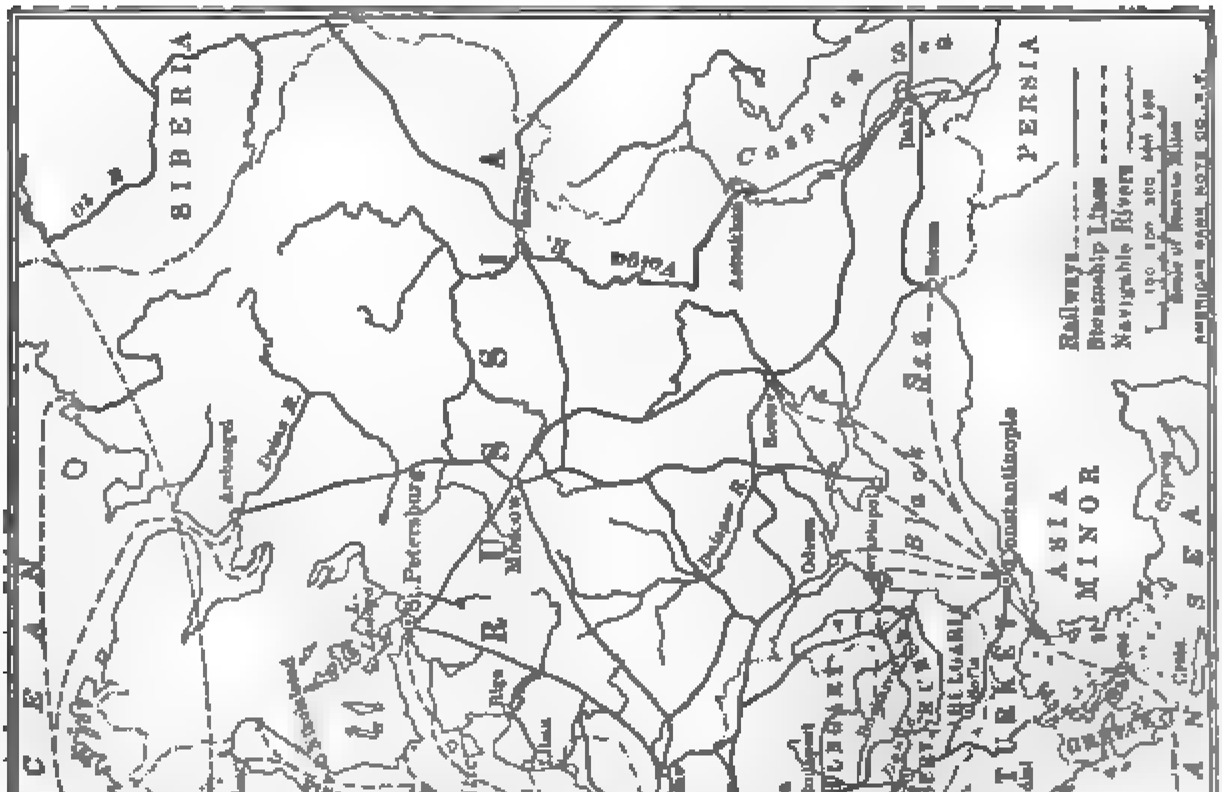


Fig. 223.—Trade routes of Europe.

Two Sets of Routes.—The commerce has developed two sets of commercial routes: first, the heavy traffic routes, which are chiefly water routes; and, second, the fast traffic routes, which are chiefly overland routes. The distinction between the two cannot always be sharply drawn, and the commerce of the first sometimes uses parts of the routes of the second; but, broadly taken, there is a distinct division. Another way of separating the two elements is to consider the routes that go around as the heavy traffic routes, and those that go across as the second class or light traffic routes. In each group there are two classes, primary and secondary, or trunk lines and branches. As the world commerce centers in the north Atlantic, so the European commerce centers in the northwest, in the region between Denmark and the Bay of Biscay. Routes radiate from this populous industrial region to the less populous regions, to the northeast, east, and south.

Two great heavy traffic trunk routes are furnished by the southern and northern seas—the sea routes skirting southern Europe to the Black Sea and northern Europe to the Gulfs of Finland and Bothnia and the White Sea. The secondary heavy traffic routes, the feeders to these main water routes, are the navigable bays and rivers and the railroads, which, like the rivers, run in most cases toward the sea, and carry inland products down to the ports. In the north of Europe the drainage is simple, the country is open, and the building of railroads to the ports is much easier than it is in the south where the mountains come so much nearer to the sea.

The Great Southern Route.—From Gibraltar to Constantinople, the southern route is poor in the branches that navigable rivers furnish. There are two navigable rivers of third-rate importance, the Ebro and the Po, in addition to the second-class Rhone. The Po is practically choked with mud at its mouth—a condition which is usually found in rivers flowing into tideless seas, such as the Mediterranean.

The mountain wall of the Alps shuts the Mediterranean away from the waters of the land, but the low shores of the Black Sea permit that body of water to drain much more than its proportional share of Europe. It receives the Danube, a river draining the very center of Europe, and navigable throughout most of its

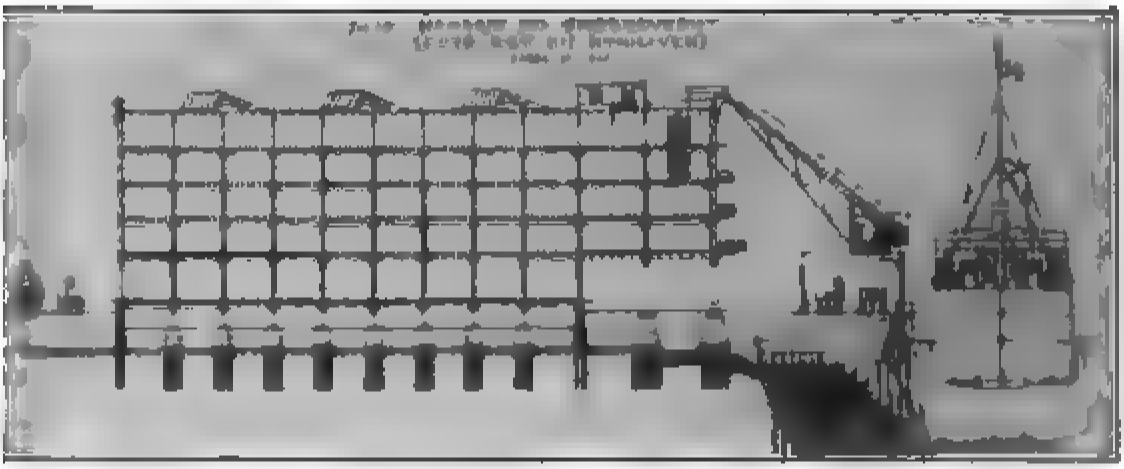
length. In recent years it has been made an international highway; and a canal, that has been cut through its swampy delta, avoids the dangers of its multitude of broad and shallow mouths, and permits the entrance of ocean-going steamers, which ascend to the Roumanian ports of Braila and Galatz, there to take the grain cargoes that have come down in barges through the Iron Gate from the plains of Hungary. A more direct route for this important traffic, which is often bound for the lower Rhine Valley, would be directly up stream and over land or through shallow canals, but the cost of land or small-barge transportation is too great in comparison with the river-sea combination. For the same reason the Austrian stream of heavy freight flows away from the Adriatic, which, though nearer, is cut off by a high divide, and is of less service to Austria-Hungary than the Danube.

The Black Sea traffic is further enriched by the steamers on the Dniester, the Dnieper, and the Don rivers, and by the south Russian railways which help to assemble the Russian wheat and corn at the ports of Odessa, Kherson, Nicolaief, Taganrog, and Rostof, where the tramp steamers congregate in hundreds. The Black Sea ports of Batum and Poti in the Russian Caucasus are heavy exporters of petroleum and ore.

The Great Northern Route.—The northern penetrator of Europe, terminating at St. Petersburg and Lulea, is favored by receiving more navigable rivers than its southern counterpart. Two of these are the Rhine and the Elbe Rivers, which must be classed as of the first magnitude if measured by the commerce that they carry. The Elbe carries down to Hamburg the products of central Germany and of Bohemia. The Rhine has with great labor and expense been made and kept navigable from the dykes of Holland to the waterfalls of Switzerland. Other contributions of freight are supplied by the Tagus, the Garonne, the Loire, the Seine, the Weser, the Oder, the Vistula, the Niemen, and the Duna, as well as the canals which thread the plain of north Europe from the west of France to central Russia. The gentle topography and easy drainage of north central Europe thus give many avenues to the sea.

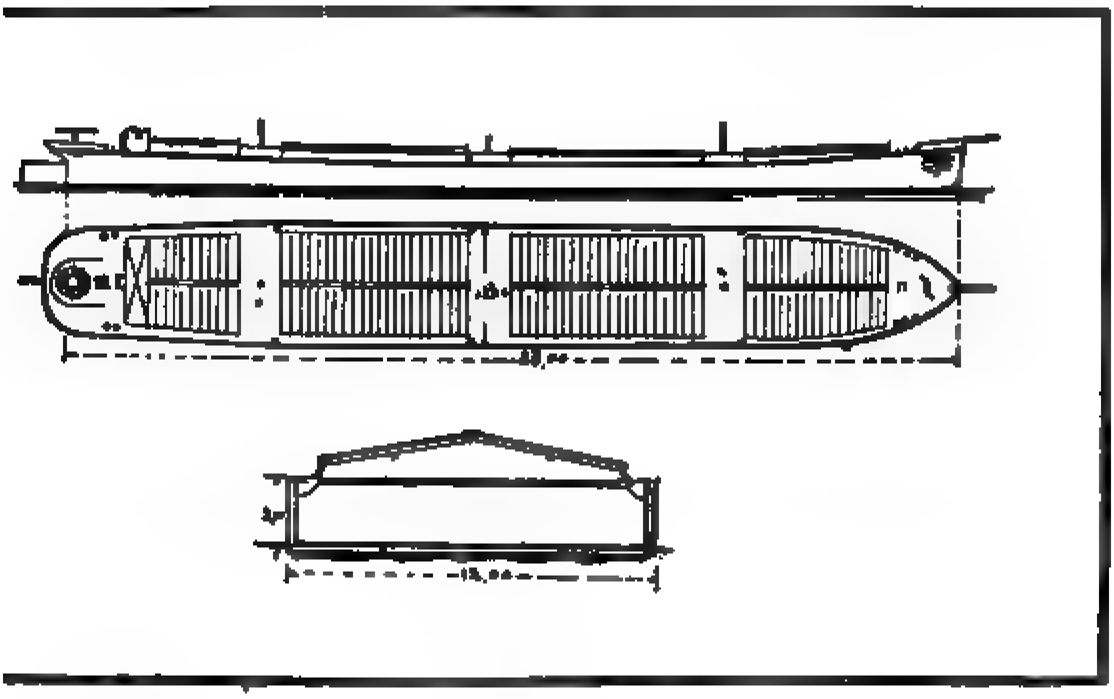
Especial emphasis should be laid upon the valleys of the Elbe, the Rhine, and the Seine. The Rhone Valley, also reaching the center of France, is like them. Each contains a navigable river

two lines of railway following it. Each has at least one commercial city at its mouth—Marseilles by the Rhone, e by the Seine, Hamburg by the Elbe, and Antwerp, Rotter-



. 223.—Cross-section of freight ship. Quay warehouse and railroad tracks tterdam. Stone quays stand on piles. The piles penetrate brushwood sses placed on the mud to hold it. Cranes operated by hydraulic power.

and Amsterdam within reach of the mouths of the Rhine. e last are the termini of the greatest of all the inland



24.—Plan, elevation and cross-section of a Rhine boat. (After Paul Goode.)

pean trade routes, because the Rhine Valley is the greatest trial region on the continent, and has the most efficient and sive river transportation in addition to the busy railroads.

The northern route is bifurcated, the lesser branch passing out in the open sea around the coast of Norway and into the White Sea, which, despite its Arctic location, has in its port of Archangel a heavy shipper of grain and lumber. The ports of Norway add their contingent of lumber, also iron ore, and fish.

The Work of the Heavy Traffic Routes.—The heavy traffic routes of European commerce, skirting the continent, and fed by the secondary routes[1] enumerated above, are served by a multitude of coasting vessels, both steam and sail, large and small, giving access to every port of Europe and to every country except to Switzerland and Servia; Switzerland has Rhine boats and Servia has Danube boats. It is by ship that the heavy freight of Europe is carried; the traffic in which economy of cost is more important than economy of time—the wines, fruits, and oil of Spain, France, and Italy; sulphur from Sicily; dried fruits from Greece; wool from Turkey; grain from Hungary and the Black Sea; petroleum from the Caucasus; sugar from Germany; wood from Scandinavia and Finland; grain from Baltic Russia; British coal; Belgian cement, glass, and iron; and the machinery and the heavy manufactures of Great Britain, Germany, Belgium, and France.

A quadrangle, the corners of which are at Belfast, Berlin, Vienna, and Marseilles, roughly includes the manufacturing region, which is either the origin or destination of most of this water-borne commerce. It is a region threaded by canals and navigable rivers giving to every capital except Berne and to almost every manufacturing city of importance the advantage of barge transportation to and from the seaports, thus giving very cheap rates on such industrial fundamentals as coal, iron, wood, stone, ore, cement, cotton, grain, and heavy manufactures. The efficiency, the importance, and the function of the heavy traffic routes is better shown by some of the more extreme cases. Regular lines of steamers carry freight from Hamburg and Rotterdam to Trieste, to be distributed in Austria by rail. The writer has seen, on the quays in Antwerp, iron bridges that had come by Rhine boat from Dusseldorf, and were en route to

[1] It is reported that "nearly" nine-tenths of the freight of the Magdeburg district of central Germany is carried by the Elbe. U. S. Con. Rep., No. 8., 1907.

Roumania by the next Black Sea steamer. There are even regular lines plying between such extreme points as Constantinople and Odessa in the south and St. Petersburg in the north

Utilization of Transport Resources.—This region of northwestern Europe has the most fully developed transport system in the world. It is a labyrinth of canals and the rivers have been improved at great expense. In an area of 800,000 square miles

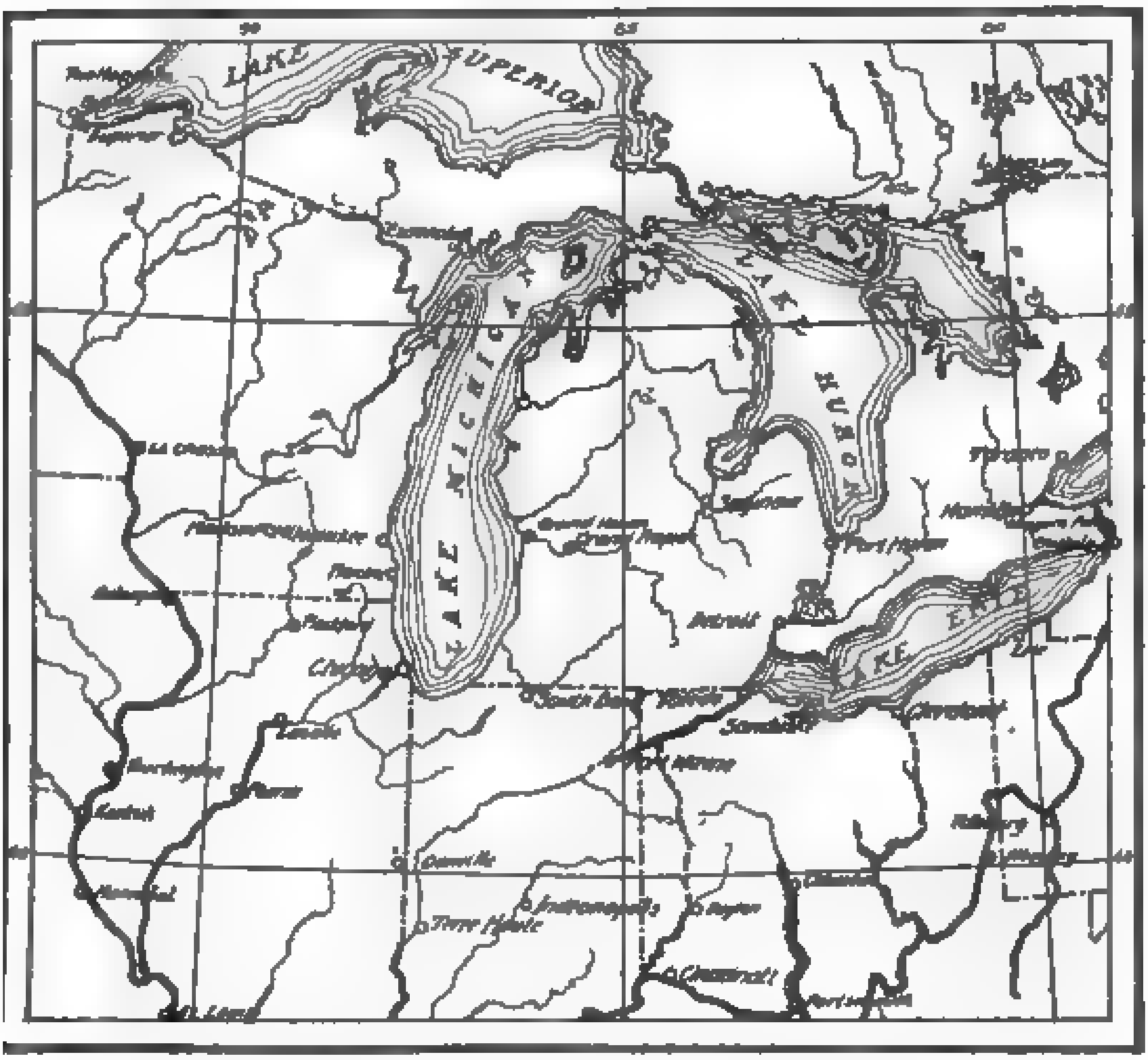


FIG. 225.—Navigable waterways in the North Central plain. (After Paul Goode.)

billion dollars have been expended in waterways. This, owever, is the trifling sum of $2 per acre and it has paid many imes over in the increased ease and cheapness of commerce. 'he results of deliberate effort are shown by the upper Rhine avigation. In 1893 this river was navigable only seventy days etween Mannheim and Strassburg, but owing to the deepening nd care of the river by the government of Baden and Alsace-

Lorrain it was navigable for 356 days in 1910. In 1909 the Rhine carried 58 million tons of freight, the Elbe 17 million, the Oder and the Weser Rivers 8 million each. The total for Germany of 118 million tons was about six times the United States total of 19 million (exclusive of the Great Lakes traffic). Russia is reported to have 57,000 miles of waterways, Germany 11,000,

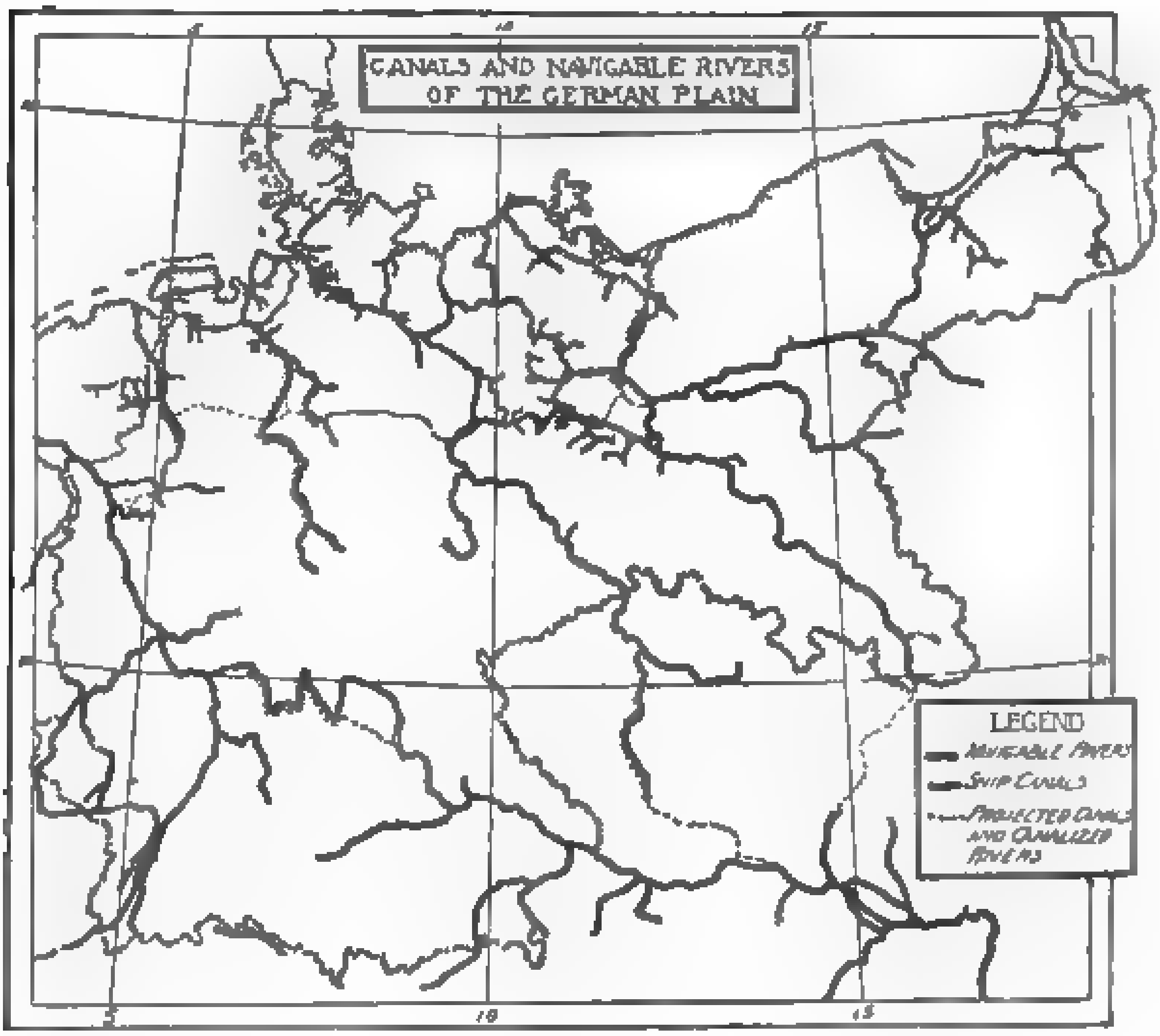


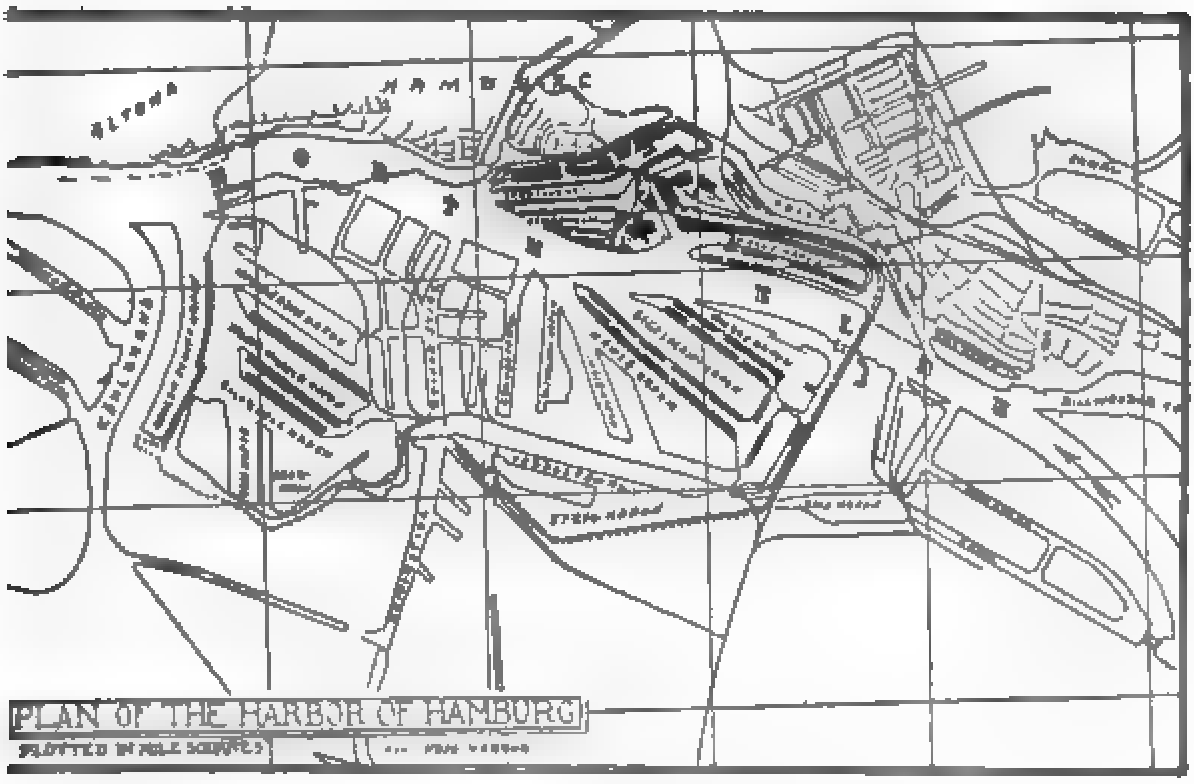
Fig. 226.—An area of the German plain equal to that shown in preceding figure. (After J. Paul Goode.)

France 7,800, Austria-Hungary 4,000, England 3,900, Holland 3,200, Sweden 3,100, Belgium 1,400.

The efficiency of Europe's water routes and the important part that they perform in her commerce is shown by the comparatively small railway mileage. Europe has 20,000 miles less railway than the United States, although the area is slightly larger and the population is four times as great. The railways are not necessary where there is such a wealth of waterways so well

tilized as those of Europe. Europe has no such problem as hat presented by the transportation to the sea of the vast raffic that seeks an outlet from the American Great Lakes. If he had, her railway mileage would be much greater. Conversely ; is easy to see that the access of ocean steamers to the Great akes at all times would remove the necessity of thousands of niles of railway track.

The American boast of great railway mileage refers to a record f achievement and also to a record of continental handicaps.



IG. 227—A big city on a narrow river must dig many docks. (After J. Paul Goode.)

he question of efficiency and cheapness of transportation ould not be confused with the question of natural advantages ' location. It is possible that by mechanical improvements, nity, and system of arrangement, America may get as efficient rvice as Europe, although the routes are not so favored by ature. The many independent states of Europe form a bar such a thorough organization of railway traffic as exists in the nited States, where uniform regulations exist over a wide area, nabling the railroads to perform wonders in transportation that ave not been elsewhere duplicated.

The Volga and the Caspian.—In the class with the great water routes of west Europe is the Russian inland system comprising the Caspian Sea and the Volga River. This is the nearest European counterpart to the American Great Lakes. It fully equals it in length, but the commerce is by no means so vast. The river and the sea give a great diagonal stretch from the heart of Russia and Russian industry far into the confines of Asia, and offer an excellent avenue for the heavy trade that arises in districts with heavy products and with reciprocal needs. In the northern part of the Volga's course its navigable western branches lie in the manufacturing and commercial regions of Moscow and Novgorod. The northeastern branches come down from the lumber regions. The main course of the river is through a grain-producing and later a pastoral region; and, on the Caspian, the greatest petroleum district in the world lies at the point where the Caucasus Mountains project into the sea. Steamers pass from the coast of Persia to the heart of Russia and connect with canals that go on to the Baltic. There are great fisheries in the Caspian, and fish and petroleum are shipped upstream in exchange for lumber and manufactures.

The Fast Traffic on Overland Routes.—The water routes that surround western and central Europe afford an excellent basis for the heavy commerce upon which industry rests. But these cheap and therefore important routes are slow, and in a region so populous and so advanced in industry there is a large traffic that requires the most expeditious routes—the railroads. Passengers, mail, and valuable or urgent freight use these routes. For through traffic of this character there is a well-organized system of railway trunk lines performing a service which is quite distinct from that of the heavy system with its feeders. The fast traffic routes connect the great centers of population, and the quickest time is therefore often made over somewhat circuitous routes that happen to pass a number of large cities. The configuration of the country sometimes helps population centers to locate the fast traffic routes of Europe with some disregard of distances.

Paris and London as Railway Centers.—Paris is probably the greatest railway center of Europe, but London may properly be taken as the starting-point for the fast railway service that

connects all the capitals of central and western Europe. The British capital is the starting-point for an enormous mail and passenger movement. The city is the center of the British railway system, having direct and very fast connections with Edinburgh, Glasgow, Liverpool, and Cardiff, and a fast mail route to Cork, Ireland, where the out-going steamers take the American mails with some saving of time. A link in the Cork mail route is the Irish Sea steamer service, in which the fastest merchant steamers in the world ply between Dublin, Ireland, and Holyhead on the Island of Anglesea, off the coast of north Wales.

There are five routes from London to the continent with quick and frequent service, and the time tables of continental railways advertise the London connections with their lines. The continental routes spread out to the south and east of London like a fan. Paris may be reached by two routes: via Southampton-Havre (steamer) and via Dover-Calais (steamer), the latter being the most used. From Paris the southwestern route passes Bordeau and Madrid and ends at Lisbon. Another line runs southeast from Paris and divides north of Lyons, one branch going down the Rhone Valley to Lyons and Marseilles; the other, going southeastward, passes through Mt. Cenis tunnel to Turin, Genoa, Leghorn, Rome, and Naples. This is the usual route for passengers between London, Paris, and Rome. A route nearly parallel to this is the Oriental mail route from London via Harwich-Flushing (steamer), the Rhine Valley, Basle, the St. Gothard tunnel, Milan and Bologna to Brindisi. The oriental mail thus leaves London several days later than the steamer which finally gets it at Brindisi. The region lying between Vienna and London is populous, highly industrial, and so well covered with a network of railways that it is possible to traverse it in many directions. Several regularly followed routes connect the British and Austrian capitals. The Danube Valley is usually entered from the Elbe Valley by way of Dresden or Berlin, or from Frankfort or Strassburg in the Rhine Valley. From Vienna this southeastern route extends, with regular express train service, to Budapest, Belgrade and Constantinople, and, by a division near Belgrade, to Salonica, whence steamers depart to Athens. There is under consideration a

plan to extend the railway to Athens, and make Piraeus instead of Brindisi the Oriental mail port.

The last of the routes starting from London goes to Berlin by way of the Rhine mouth ports and Hanover, and it also extends to Warsaw and St. Petersburg. It is the mail route from Russia, and to some extent for Germany also, to England, and America, because the train is faster than the ship and this rail route makes its final connection with steamers at Southampton or Cork.

The Trade Routes of Russia.—There is across Europe one east and west route of much importance and greater promise—that of the Asiatic express. Although it might be said to begin at Madrid or Lisbon, Paris is the real beginning and the place from which the Russian and Asiatic express trains start. At Warsaw the route divides, the northern arm going to St. Petersburg, the southern to Moscow, eastern Russia, Siberia, and China. This is the route of promise. The heavy mail from west Europe to the Orient is to be reckoned as the first capture of the new trans-Siberian Railway from the slower circumcontinental steamers. As the vast and fertile plains of Siberia develop into an empire, the chief avenue of its economic and intellectual life will be along the railway running east from Moscow, and this trade route will in all probability far outstrip all other European trade routes in the rate of increase in its traffic. This is the more certain because this route differs from all others in that there is no water competition for the larger part of its territory. The only possibility of a water route to western Siberia is by the River Obi. The river itself is very favorable for navigation, but it has not yet been established that vessels can safely visit the mouth of the river to carry away the freight that river steamers might bring down. At best, the Arctic will keep it closed except for a few weeks in summer, when a fleet of steamers might make a rush for the accumulated freight. Efforts in this direction have proved costly failures. On the southern side also Siberia is closed from the Indian Ocean by the deserts and plateaus of central Asia and by the great distance. These circumstances serve to emphasize the importance of the land route to the Baltic, the nearest open sea, and the real goal of the greater part of Siberian commerce.

The traffic over the western part of this route is being in-
ɜased by the contribution of a new railway from Turkestan
d central Asia. This branch separates from the main line
st of the Volga, crosses the Ural at Orenburg and connects
Tashkent with the central Asian system, giving the most
:ect route to this part of the Russian domain.

Russia has two other routes to her Asiatic possessions, both
nnecting with the western end of the trans-Caspian Railway
stem. Although its traffic is greater than ever, the monopoly
the Volga route was broken by the trans-Caucasian Railway,
nnecting Batum on the Black Sea with Baku on the Caspian.
eamers finished the connection with Russia proper by way of
e Black Sea, where steamers linked Batum with Odessa,
bastopol and Taganrog on the Sea of Azof, whence railways
nt to Moscow and St. Petersburg. In 1899 Baku achieved
ect rail connection with St. Petersburg through the comple-
n of a line along the north slope of the Caucasus to Rostof
the Don. This affords a quicker and more direct route to
ntral Asia, and one that is more secure in case of war with a
eign power. As long as connections depended upon navi-
ting the Black Sea, a foreign navy might at any time interfere
th that part of the route.

Eastern and Asiatic Russia are as much the frontier of Europe
the Great Plains and Rocky Mountain States were the fron-
r of the United States in 1880. The economic relations of
e two regions are similar. Geographic separation between
urope and Asia is purely imaginary, and is the result of political
nditions arising from the absence of means of communication.
e extension of modernized European trade routes into north-
stern and central Asia is beginning to weld the regions into one
nomic unit in the same way that the trans-continental railways
the United States have brought the West into commercial
ations with the eastern states.

Commerce on these Russian-Asian railways has the same
sis for growth that has produced such an enormous traffic on
east and west railroads of the United States. They connect
manufacturing cities of west Europe with the cattle ranches,
in fields, and farms of the more sparsely peopled lands of
ssia's almost unsettled empire in northwest Asia.

Scandinavian Routes.—The Scandinavian peninsula is like the rest of Europe in being served by a secondary route of steam railway giving quick connection with the other capitals of Europe. Express trains between Berlin and the Scandinavian capitals are ferried across the Baltic. Commercially this peninsula is an island depending for its outside communication absolutely upon the sea, which envelops it so favorably for commerce.

CHAPTER V

THE NORTH ATLANTIC ROUTE

Geographical Factors.—To a person who has not given attention to the geography of the north Atlantic it might seem that this ocean possesses a multitude of trade routes. Yet there are certain geographical conditions producing a surprising similarity in the path followed by all of the ships going across this ocean from North America to northern Europe.

The greatest factor leading to the use of this common path is what the mariners call "the great circle line." This can be best understood by examining a globe, which one of the greatest of engineers has declared to be the only map that should be used. It is certainly the only map that is accurate. By it one sees that in high latitudes the points of the compass have little to do with indicating actual shortest lines. The shortest line between any two points equidistant from the equator is not on the parallel running due east and west, but along a line passing to the north and passing through both of the points in question, and then dividing the earth into two equal parts—a great circle. The farther apart the two points in question are, and the farther north they are, the greater is the northward curve of the shortest line between them. Consequently, there are almost no straight routes upon the charts to be followed by the mariner. He is forever following curves, because he is, of all men, the one who is most directly concerned with the fact that the world is round.

It is rather astonishing to discover that the positively shortest air line from Sandy Hook to Liverpool passes directly overland through New England and Canada west of Nova Scotia. The more closely ships can approach this great circle line, the shorter is their voyage; consequently, as soon as it is possible all vessels leaving New York abandon their eastward course and swing northward along the line of a great circle, the exact point for this turn varying with the seasons. At all times of the year

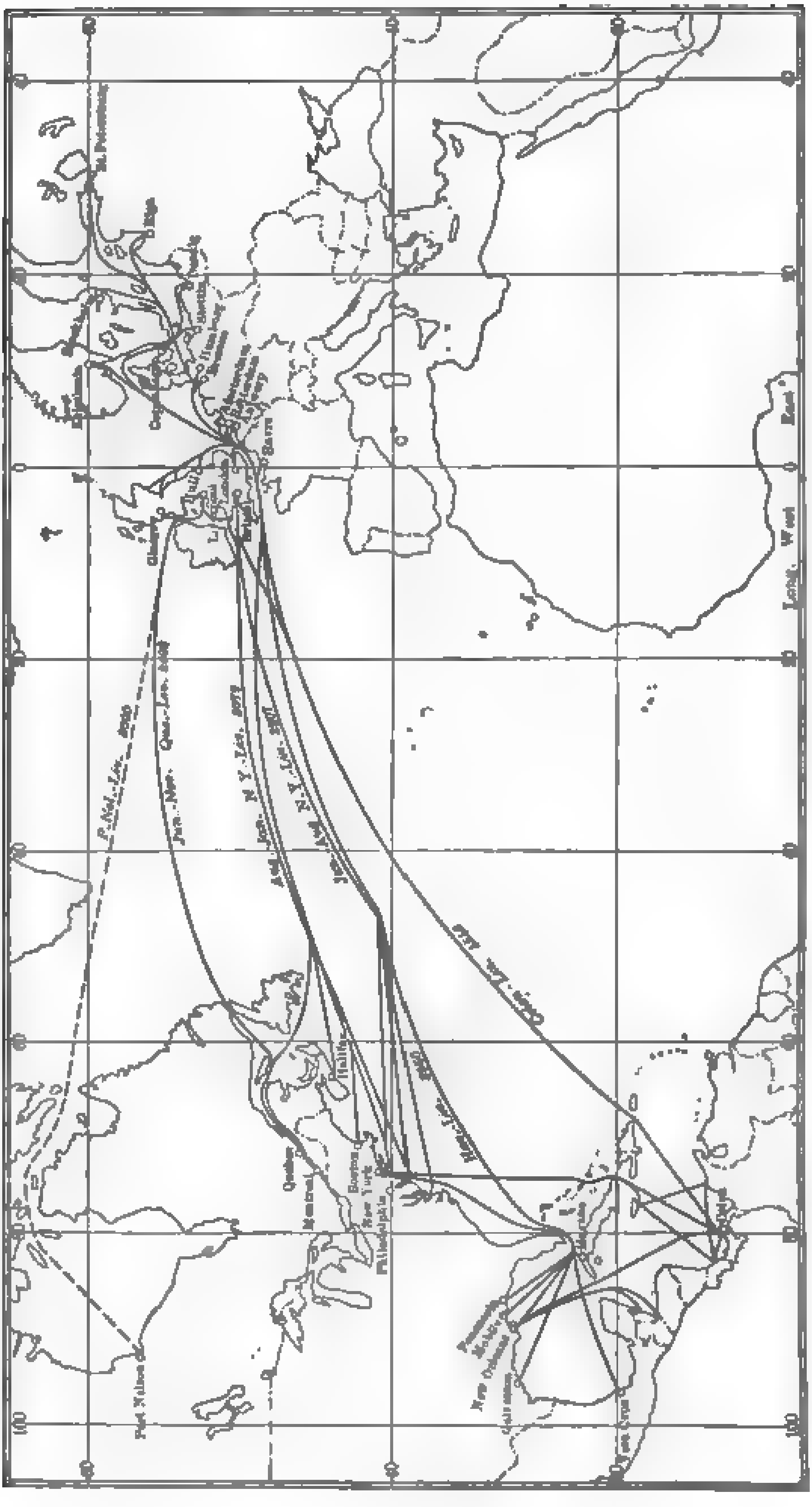


FIG. 228. —North Atlantic Trunk Route.

the vessel must proceed eastward, sometimes hundreds of miles, before it is permitted to turn to the north. Only by this means can the navigators avoid the worst dangers of the Newfoundland coast and the fog banks. The great circle swing makes the vessels from New York, Halifax, and Montreal approach each other before mid-ocean is reached and sail along within sight of each other. For a part of the year, often less than half, the St. Lawrence steamers make an exception to this by going north of Newfoundland.

An examination of the globe, or a photograph of part of it shows that the east coast of the United States, of which we often think as extending from north to south, really lies so near east and west as to be practically a part of the great circle line from the Georgia coast to Scotland; so that the ship from south Atlantic ports follows the coast and takes the same trunk route as those from the north Atlantic. This same principle goes even further and gives to the vessels from the Straits of Florida, that is to say, the vessels from the Gulf ports of the United States and Mexico, identically the same path across the north Atlantic.

In the process of a shipping controversy, the Liverpool Steamship Owners' Association once declared "that all vessels crossing the Atlantic to this country (Great Britain) from ports in North America take practically the same route from 60° west longitude." As a consequence of this fact, Norfolk is rising in importance as a coaling station for the ships from Gulf ports. Even Nicaragua is almost within the territory of this same north Atlantic route, for it is but 323 miles further from Grey Town to Liverpool via New York than via the shortest possible route. It is thus plain that the north Atlantic route is a great trunk route with a string of branches for the different ports from St. Johns in Newfoundland to Havana, Tampico and Vera Cruz in the tropical Gulf.

It is, therefore, exactly in accord with these basal facts of location that there is now arising a trans-shipment trade at New York and New Orleans by which the products of the West Indies and Caribbean countries are being forwarded to Europe by the great trans-Atlantic liners, and return cargoes come by the same route. It is almost as short as any route, and the Hamburg American Company, now owning the Atlas line from New York to the West Indies, advertises in Europe that the quickest way

to get goods to those isles is to ship European goods over their fast trans-Atlantic lines for trans-shipment at New York.

It is a working out of the narrowing longitude of high latitudes that causes Quebec and Montreal, which we are inclined to think of as being far in the interior, to be nearer to Liverpool than are New York and Boston; while the distance is no greater to the trading posts located far in the center of the American continent

FIG. 229.—Globe shows narrowness of North Atlantic and cause of location of North Atlantic Trunk. (Photo E. Stirling.)

upon the western shores of Hudson Bay—a fact interesting to speculate upon.

The north Atlantic route has the great advantage of being entirely devoid of islands with the exception of Sable Island—the so-called graveyard of the Atlantic—east of the Maine Coast and a few small rocks on the Grand Banks. So universally are these skirmish posts of the continent dreaded that the route for the trans-Atlantic steamers aims to interpose 60 miles of clear

water between the ship and these destroying landspecks. This is the more necessary because of the mingling together of the Arctic current and the warm Gulf Stream which produces well-nigh continuous fog on the Grand Banks. The handicap resulting from these difficulties is well-illustrated in the St. Lawrence River, one of the feeders of the Atlantic route, where the narrow and rocky channel has been frequently the scene of great disasters and where at the present time ships must often tie up during the night. The result of these dangers produces an insurance rate often several times as high as that for open sea voyages.

The icebergs, almost continually afloat in the region of the Grand Banks, are a greater menace than a group of islands.

Another dangerous part of the route is Cape Hatteras, which really projects into the Atlantic and, with its long strings of sand bar reaching out to sea, must be rounded by hundreds of vessels from the south, and, in the temptation to save distance, many a good ship has ventured too near these bars and met her end.

Winds and Fuel Supply.—The north Atlantic, a region famous for its storms and strong winds, was, in the sailing vessel epoch, a route where some wind could always be had. The ship was never be-calmed, and the record of the zone of calms shows this to be a matter of importance, although it was often necessary in the winter time to make a great detour to the south to avoid the steady winds from the west. This was particularly the case in the colonial times when ships were small and rigging was ill equipped for headwinds. In those days it was common for the ship to return by way of the Canaries and West Indies and beat up the Atlantic coast. Even at the present time our pilot charts recommend a winter returning route that actually dips below the tropics to enable the skipper to take advantage of the trade winds which will speed him westward. While we boast of the age of steam, the best of steamers have done little more than double the best record of trans-Atlantic sailing vessels going east; but, practically, they have much more than doubled their efficiency because the average sailing vessel is so much more below her own best record than is the average steamer.

In the present epoch of steam no route equals the north Atlantic in the abundance of the supply of fuel. Eastern

America and north Europe are producing 95 per cent. of the world's coal and this supply is on both continents admirably distributed for the supply of steamers. On the American end there are four distinct fields: east Canada is supplied by Nova Scotia; the Middle Atlantic States from Pennsylvania; Chesapeake ports from Maryland and the Virginias; at New Orleans and the other Gulf ports there is Pennsylvania coal, carried down the Mississippi river in barges at minimum cost; and Mobile has Alabama coal under equally favorable circumstances. The European end has a distribution of coal that is not less complete. Southern and western England with the ports of Bristol and Liverpool are supplied from the rich fields of Wales and Lancashire; Glasgow almost overlies the coal-fields of western Scotland. On the east lies Newcastle, synonym for coal; Antwerp and Rotterdam, the great ports of the Rhine, are in reach of Rhine-borne coal from Westphalia and Belgium; Hamburg and Bremen receive their coal very cheaply as return cargo in ships which carry sugar to England, and German coal can also come down the Elbe on barges from the east German coal-fields. Another fuel supply that should be mentioned is the oil of Texas, Kansas, and Oklahoma in the lower Mississippi Valley. This is now used to a limited extent and may at any time become of greater importance.

Traffic.—The north Atlantic route began as one over which emigrants left Europe to start new homes in America; and, strange to say, this traffic, which was the first over this route, is also the last and one of the greatest. In the first ten years of the twentieth century, more emigrants by far landed from trans-Atlantic steamers than had succeeded in reaching America in the two and one-half centuries preceding the year 1850. In addition to this prodigious immigrant traffic it is also the greatest travel route of the world and the greatest freight route, and consequently the route possessing the largest, fastest, and most complete ships that ever floated.

It is upon this route that have occurred the fiercest fights for international supremacy. Here in the middle of the nineteenth century occurred the great Anglo-American duel between the rival American and British lines, the Collins and the Cunard. In this struggle the American line was the faster, but ultimately

victory was not to the swifter. The Cunard has now outlived the Collins line by almost half a century and the British marine has replaced the American. The last twenty years have seen an equally keen competition among the English, the German, the French and American lines, which are here rendering the best ocean service for both freight and passengers that the world has ever seen.

The north Atlantic traffic has always been of a dual nature. The emigrating European has been finding a home, and the manufacturing European has been finding raw materials. This has given to the passenger and freight traffic a continual condition of unstable equilibrium. There are more passengers moving west than east; there is more freight moving east than west. Thus, there are, with the exception of certain short seasons of the year, unused passenger accommodations on the steamers setting out from America, and there is never even a temporary respite in the movement of empty freight vessels from Europe for American cargo. America has been sending raw materials in great bulk—cotton, wheat, corn, meat, lumber, copper, and cattle foods—and receiving manufactures of much smaller bulk. This was true in the first days of the Virginia colonists' settlement when they were saved from starving by the fortunate discovery that the people in the home country would pay them for shiploads of savory and bulky sassafras bark, with which the early colonists at Jamestown were able to purchase bread, clothing, and necessary manufactures which they could not themselves make. The medicinal virtues of sassafras bark were found to be largely imaginary, and the trade fell away to be followed by an unending succession of tobacco ships, grain ships, and lumber ships; and, in the last decades, American manufactures have added a new class of traffic, chiefly bulky products of wood and steel. Now, as always, the return freight is of much smaller quantity and of higher value, so that many of the ships go out fully laden, and most of them come back with partial cargo, and many with no cargo whatever except worthless ballast.

This traffic in ballast, which makes a load valuable for its weight only has brought us hundreds of thousands of tons of sand and stone of less than no value; but the necessity of carrying

something has caused the Atlantic ships to bring at times coal, iron ore, iron, chalk, china clay, and such bulky freight from Europe at minimum cost as ballast substitutes. This ballast traffic is not now so imperative because the newer ships have water tanks which they fill and empty with their own engines at practically no cost; but a voyage without cargo must nevertheless always be a loss.

The traffic future promises that our freight movement will not increase so rapidly as it has in the past. America, with her tremendously increasing population and her great mills, is using more and more of the raw material, has less and less for export to Europe. The fact that we are establishing manufacturing industries means also that we have a lessening demand for European goods, so both upon the side of production and on the side of consumption there is a prospect of lessened dependence of America upon Europe, and lessened demand for commerce upon the north Atlantic trunk route. Although it is also scarcely conceivable that there can be any large extension of the emigrant traffic to America, there is every indication of the steady growth of travel between the two continents.

Ports.—One of the accompaniments of the nineteenth century revolution in world commerce has been the changing of seaports. Seaports have changed in two ways. The first of these changes has been the physical renovation and rebuilding of the ports and deepening of harbors and channels to accommodate the enlarged steamship and the consequently enlarged trade. The second and yet more important change has been the shifting of the centers of distribution through the relative decline in the importance of the old, and the rise of the many new centers. These changes have been of greater influence in the north Atlantic than in any other of the world's great routes.

The great increase in trade during the last quarter century has produced a multiplication of the lines of vessels, and consequently a great breaking down in the centralization that arose in the distribution and collection of the traffic to and from a few great ports which had been monopolizing it. There was a time when London and Liverpool almost monopolized the line traffic between Europe and America, but other cities rose to the position of claiming their share from America direct rather

than through the intermediate ports. Liverpool saw Bristol rise to the south of her, Glasgow to the north of her, and Belfast across the Irish Sea. London has lost trade through the rise of Antwerp, Hamburg, and Havre, which ports in turn have established coasting lines and have snatched from London a part of the distributing trade of Scandinavia and Russia. But this was not the end. The establishing of coasting lines was scarcely complete at Hamburg and Antwerp, when the same process went further, and yet another set of rivals arose. There sprung up a direct trans-Atlantic connection that gave to Hull, Copenhagen, Stockholm, St. Petersburg, and Bordeaux the ability to get some of their goods without dependence upon either the new intermediaries, Hamburg or Antwerp, or the old intermediaries at London or Liverpool.

A similar development has occurred on the western end, where New York, while growing steadily in the annual amount of her traffic, is proportionally losing trade to her rival ports like Montreal and Boston, Baltimore, New Orleans, Galveston, and Pensacola.

But with all the multiplying of lines and of services there is no multiplying of routes, only another straw is added to the mighty sheaf of tracks bound together in the mid-Atlantic but spreading at the ends to include Finland and France, Newfoundland and Yucatan.

The rising of new services from new ports has apparently had no influence on the growth of trade in the old. The ports of Europe are steadily increasing in traffic and are chronically and almost universally out-growing themselves and making new facilities. After fifteen years of discussion the port of London is about to have $70,000,000 worth of improvements. The city of Antwerp is in process of spending a like sum. The harbor authorities have gone into the fields beyond the city and made a great new harbor. When completed the port will have 30 miles of solid stone quays, and 800 acres of freight sheds.

Manchester, tiring of what were considered high freights to and from Liverpool, built a ship canal 26 miles long and a harbor. It gave the desired low rates by direct ship and then by the railroads that competed with the ships. The year the canal was opened

its traffic was 686,000 tons and in thirteen years it increased to nearly sevenfold. Its effects upon the location of industry are seen in the rise of a flour-milling industry and a grain import that rose from 15,000 tons in 1894 to 493,000 tons in 1911.

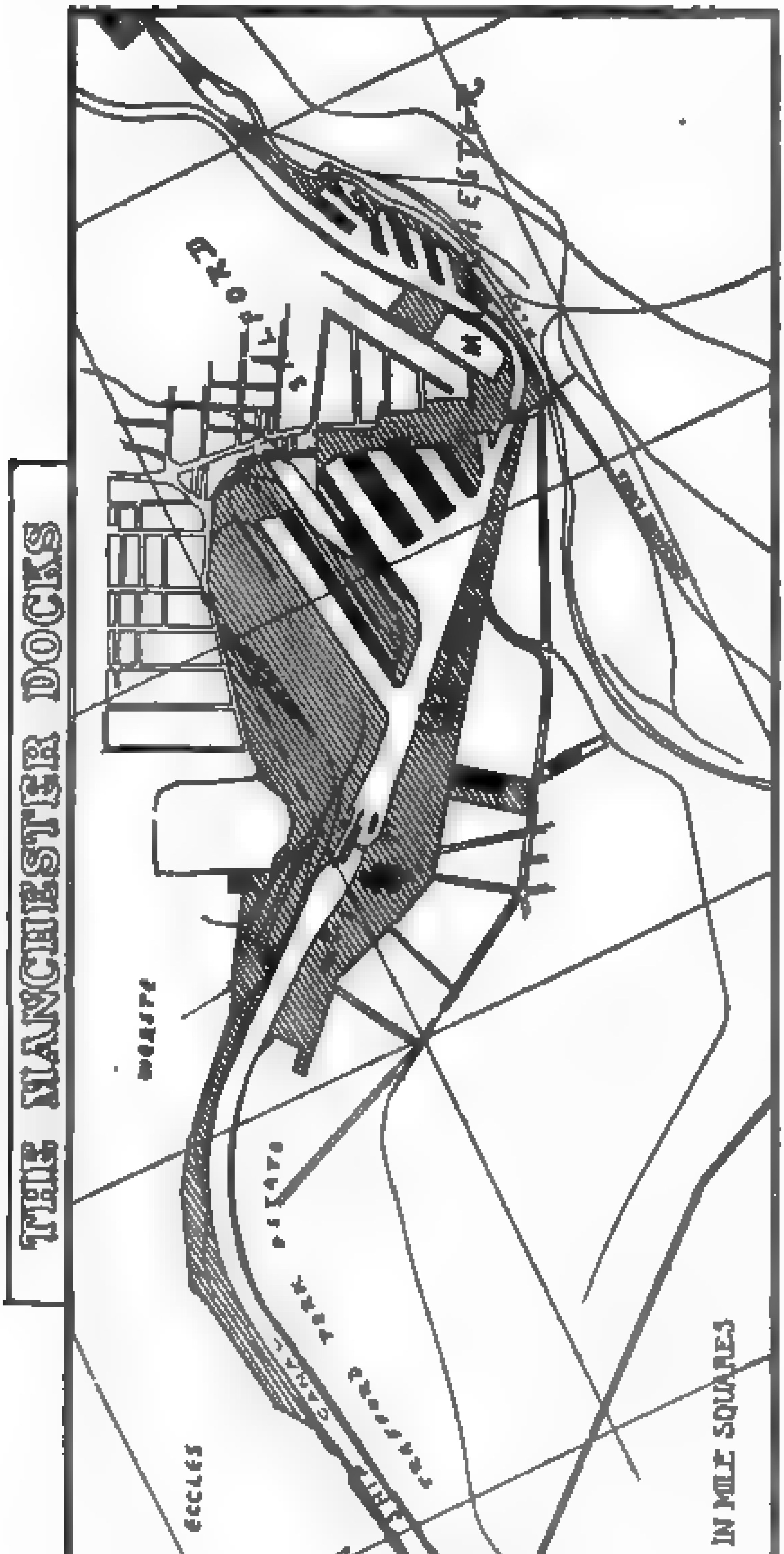


Fig. 230.—The Trafford Park Estate is being developed for factories and commercial uses and the city is growing in that direction. (After J. Paul Goode.)

CHAPTER VI

THE TRADE AND TRADE ROUTES OF ASIA

Geographic Handicap to Asiatic Transportation.—Asia is old. Asia is in an infancy in which the old peoples, gripping the tools and mechanisms devised in the west, are starting forward to the rebuilding of their old continent, and to the rediscovery of world power. She is the seat of ancient civilizations and of the oldest extended commerce; yet that commerce has always been handicapped by geographical hindrances which will tend to impede her new trade as well. The continent of Asia is five times as large as the United States. Its mere size divides its different parts by enormous distances. The comformation of the land has presented other barriers more prohibitive than distance. There are no rivers flowing from the great central region, and trade must depend upon land transportation. Deserts and mountains add difficulties that have been well nigh insurmountable and have limited the commerce of this section to small proportions. The heavy commerce of Asia, like her dense population, has been dependent upon the great rivers and river plains of the south and east; and here only has there been trade in the food supplies and the heavier articles that are typical of present-day commerce. The rest of Asia may yet be said to lie undeveloped, awaiting means of transportation except where the Russian railroads have made a beginning.

The Importance of Asiatic Rivers.—The Yangtse-kiang is the greatest of the river thoroughfares by which the commerce of Asia has been supported. Running from west to east through the heart of China it has nearly a thousand miles of waterway for ocean steamers and much more for native boats. The Yangtse is the great commercial artery of China for two reasons. First, because of the navigable branches flowing into it from north and south, and the far-reaching system of canals that open up great tracts of territory. Second, because of the

ıdous populations that are dependent upon these water-
The rapids at the Yangtse gorges are still a great hind-
to up traffic; but the river gives the western province of
ın, with its score of millions of people, a better outlet

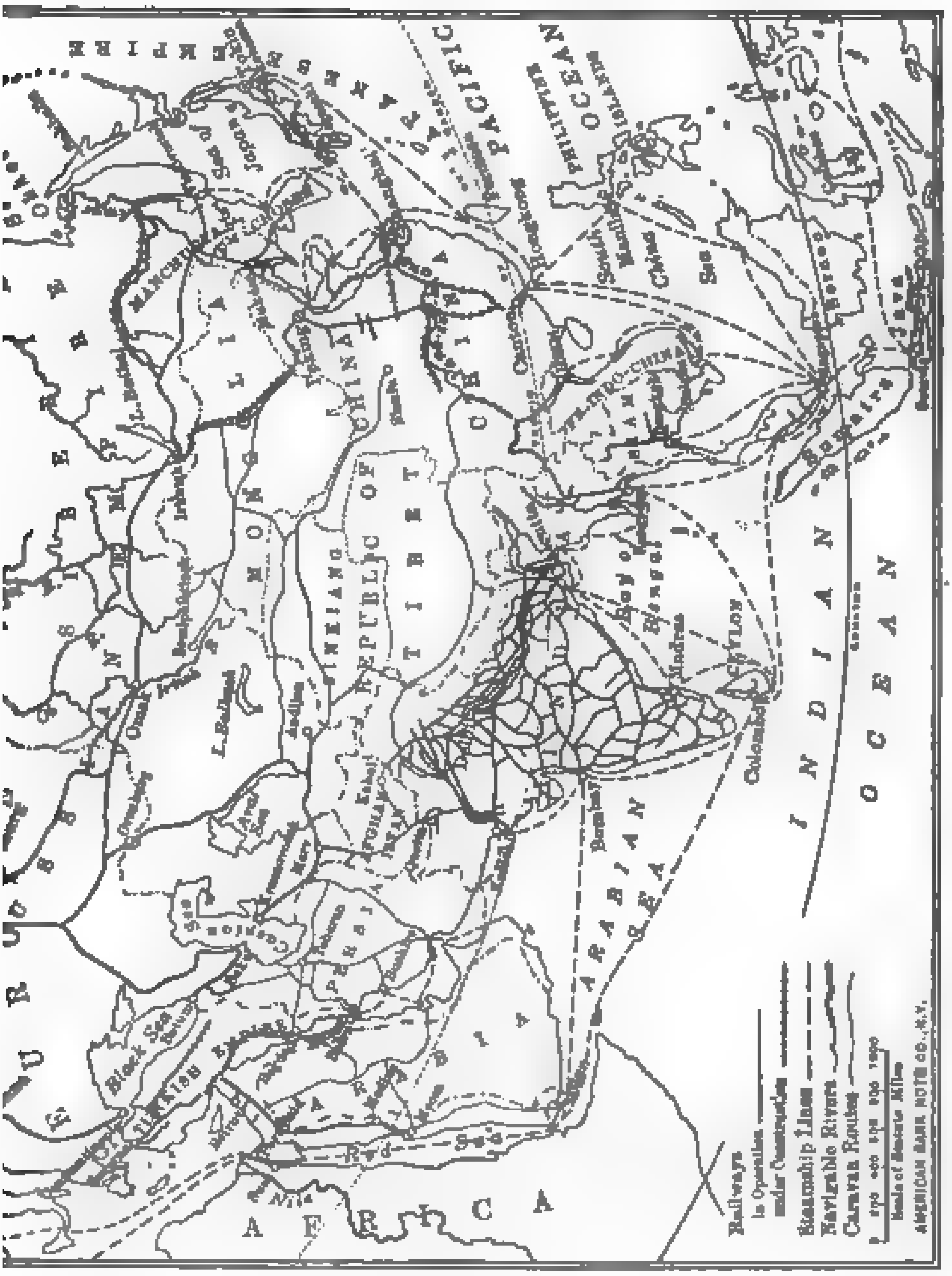


Fig. 231.—Trade routes of Asia.

he state of Ohio had in 1810, when all agricultural pro-
ıad to be sent to New Orleans by flat boats which could
turn. The Chinese are able, by ardous human labor, to
ıeir boats up the rapids. About a million tons cleared

upward from Ichang in 1910. It is plain why Shanghai, the gateway to this great valley, is one of the great ports of Asia and of the world, and is destined to greater growth. It is both the New York and the New Orleans of China. It exports tea, silk, iron ore, and Chinese wares and imports kerosene, cotton, grain, flour, lumber, railroad materials, and manufactures in great variety.

In south China the Si-Kiang or West River and its canals perform the same function as the Yangtse-kiang, but for a smaller area, having its metropolis at the great port of Hong Kong. In north China the great river Hoang Ho is useful for navigation only for short stretches because of the vast quantities of loess mud that it carries. The metropolis of its valley is Tientsin, the Port of Pekin, with which it was connected by one of the first railroads in China. The only other river of importance is the Liao, which is useful to shipping from New Chwang to some distance north of Mukden.

In Indo-China and Farther India the proportion of occupied territory is smaller than in China and India and the settlements of trading people are all on or near the navigable rivers Mekong, Menan, Salween, and Irrawadi, which constitute practically the only outlets and are served by both native craft and European steamers. Thus Rangoon, at the mouth of the Irrawadi, Bangkok at the mouth of the Menan, and Saigon at the mouth of the Mekong become the great rice-exporting ports of the world. They also export much teak timber that has been floated down stream.

In India the seats of ancient empire and trade were the rich valleys along the navigable courses of the Ganges and Brahmaputra, and in lesser degree along the Indus. Here are the historic names. The British Administration in India has improved these rivers and built railroads through their valleys so that Calcutta and Karachi, the ports near their mouths, are growing in population and commerce. Calcutta is the world's great jute exporter, and Karachi is a grain port. In Madras and Bombay we have cities that depend chiefly upon the railroads that center there. In this respect Bombay is a nineteenth-century city, a railroad city, and its location near the districts of wheat, cotton, and oil seed production has made it

for a time the first port of Asia. Commercially, it is a city of the West dependent upon the railways built by the British, but in the large shipments of essential oils it shows its dependence upon the cheap labor of a densely peopled land. There seems no reason to think that Bombay can long hold the port leadership of Asia in competition with the superior resources and population of the Shanghai hinterland.

Caravan Routes.—With the slight exception of the navigation of the Tigris, the commerce of the remaining and by far the larger part of Asia, was, until the recent railroad building in Asiatic Russia, dependent upon the land caravan. The entire north is shut off by the Arctic ice; and, in the other three directions cyclopean difficulties present themselves to the caravan drivers. On the south a vast wall of mountain and plateau under various names reaches from Asia Minor to Thibet. On the west are the wide and often arid steppes leading into the remote east of Europe. In the center the deserts of Turkestan Mongolia, beset with mountain ranges, connect Thibet with the arctic wastes of east Siberia. For thousands of years the caravan has contended against these obstacles, using horses, mules, donkeys, yaks, and men as pack animals in the mountains, camels in the desert, and wagons and sledges on the flat plains. These traders have traversed astonishing distances. The men of Pekin and Turkestan have for centuries been familiar figures at the Russian fairs of Nihzni Novgorod.

The caravans from China to the west and northwest have been chiefly the caravans of the desert, following the routes of the desert, which comes down to within less than a hundred miles of Pekin, reaches northward nearly to Lake Baikal, southwestward to Thibet and westward to the Caspian Sea. This region is much like the arid region of the United States, having oases and irrigation settlements here and there, but the desert stretches of Asia are much greater in area and often more complete in aridity than those of the United States. Across this waste China has for ages had a caravan trade, and the camel has been a familiar sight in the streets of Pekin since before the birth of any European nation.[1] The most important branch

[1] The recent building of the railroad from the sea to Singan on the Wei, a branch of the Hoang-ho, has changed the base for most of this camel trade.

of this overland trade was that with and through Siberia, the routes from Pekin and Hankow combining and reaching Lake Baikal by way of the desert station of Urga.

The Chinese caravan route next in importance passes up the Hoang-ho Valley, across Chinese Turkestan into Russian Turkestan. At Hami in longitude 94° east the route branches, the southern arm crossing the high ranges via Kashgar and the northern going to Tashkend via Kuldscha.

A third route of lesser importance connects Chingtu, the capital of the rich province Szchuen on the upper Yangtse, with Lhasa and Thibet, while a fourth connects Yunnan, a mining city in southwest China, with Bhamo in upper Burmah.

The routes that center in Turkestan are, or were, before the coming of the Russian railroads, continued to Europe by a direct route from Tashkend to Orenburg at the end of the Urals, and by a more southern route via the Caspian and Black Seas to Constantinople and south Russia.

The commerce that must traverse these enormous distances on pack animals over mountain, desert, swamp, and sand plain has pressing limitations of high freight rates which exclude anything but goods of the highest value—luxury goods, metal work, silks, cloth, skins, leather, rugs, tea, and spices. The most important of these routes, the one that passed through Siberia, had tea as the chief article of its commerce. The overland tea cargoes traveled by a variety of means. At Lake Baikal that route reached a well-watered country and the camel returned to his desert. The mud of Siberian spring-time stuck fast the wagon wheels of commerce, which in that region was therefore carried on almost exclusively by means of sledges over the dependable snows of the Arctic winter. Therefore, the tea rested where the spring thaw caught it and proceeded westward when the next snowfall again permitted the movement of goods. Such were and to this day yet remain the only means of commerce and travel in vast areas of central Asia. Naturally the consumption of the goods from the outside world is light where such conditions prevail, and the inland settlements have always been essentially independent.

The day of the trans-continental caravan is on the wane. At best it is a poor, weak rival of the poorest railway; and, wher-

ever they compete, the caravan station becomes the embodiment of hard times and decay. The first great falling off in the overland trade came with the establishment of steamship service connecting the newly opened ports of China with Odessa, and the new railways reaching thence into the interior of Russia. The region west of the Ural Mountains could be supplied with Chinese tea and silk more cheaply by the Yangtse junks and the new water route than by the old routes, which had then no territory left but the domains of Asia. This territory was soon invaded by further improvements, and the Trans-Siberian and the Trans-Caspian railways are becoming the trunk lines for the trade of interior Asia and the caravan is reduced to being their distributor and feeder.

The Trans-Siberian Railway.—Russian Asia now has industrial conditions similar to those that prevailed in 1870 in the region between the Missouri River and the Pacific coast of the United States—a wide region, partly arid, partly fertile, not thoroughly explored and possessing a sparse population destined to rapid increase through the increased immigration fostered by pioneer railways, along which every station is the starting-point for wagons or pack trains en route for settlements scores or hundreds of miles away. The nomadic herdsmen of the black earth Siberian steppes are now being replaced by the peasant immigrant who has come to raise grain. The wandering trapper of the great forest zone to the north must, when he exterminates the fur-bearing animals, as he is rapidly doing, become a lumberman and help supply the wants of the prairie dwellers to the south. The commercial and industrial life of the new Siberia depends and will depend upon the Trans-Siberian Railway and its probably numerous branches.

At present the Siberian river systems furnish the most efficient lateral lines of communication with the railroad which crosses them. The flat plains make easy navigation. As early as 1900 there were 119 steamers and 358 barges upon the wide-reaching branches of the Ob. The Russian government built the road with light and temporary first construction, which must be pretty thoroughly rebuilt before the line can handle much heavy traffic, or develop branches. Thus far the traffic has not reached the stage where branches are necessary: The

main line is a stretch of prodigious length through the black earth plains west of Lake Baikal between the forest on the north and the arid land on the south. The long winter season and the ease of sledging enables the grain-growing peasant to haul his crop in for great distances. Sometimes the settler converts his crops into meat, kills his animals and sledges their frozen carcasses 100 miles or more to the railroad. The unremitting frigidity of the Siberian winter gives several months for this work.

It is easy to overestimate the importance of this road as a carrier of through freight that goes from ocean to ocean. In this field it must play a comparatively small part and that part will be limited to passengers, mail, and what, in the United States, is called express matter and very urgent or very valuable freight. In this class will be the silk of China and Japan and possibly tea, but with this latter commodity the sea route can make a powerful competition in the seaport regions of Russia.

Other freight, the common agricultural and industrial articles, comprising over 95 per cent of the total commerce arising within a thousand miles of any sea, can be more advantageously handled by the ships that go through the Suez Canal. It should be noted in this connection that many of the agricultural products and all of the grain of the Pacific coast of the United States were until 1899 carried to the Atlantic around Cape Horn in preference to paying the railroad freight across the United States. The railway from St. Petersburg to Port Arthur is twice as long as that from San Francisco to the Atlantic seaboard and this fact will of necessity make the Trans-Siberian line chiefly valuable as a local rather than an inter-oceanic freight carrier.[1]

The functions of the completed Trans-Siberian railway as a purely commercial carrier of freight, particularly heavy freight, would be more clearly seen if the line were considered to be in two separate sections, with the division line not far from Lake Baikal. This lake marks the end of the great Eurasian low

[1] Questions of military operations and requirements are not here considered because they must so often be conducted with reference to conditions other than those purely economic or geographic. Politically, the railroad will have tremendous influence as a through carrier of emigrants, passengers, and mail and as a distributor of the Russian language and thought.

plain. To the eastward the railroad plunges into a mountainous country and crosses the continental divide after passing many mountain ranges requiring expensive construction and high cost of operation, which tend to produce a natural freight divide. Consider the western section as attached to the European railway system and the eastern as a feeder of the Pacific commerce, and we would see the parts in their true significance as outlets running from the closed center to the free circumference of the Eurasian land mass. Western Siberia will look toward Europe, whence the western part of the Trans-Siberian line will bring the imports and take the exports of these provinces. Practically independent of this will be the developments on the other end of the railway system. This territory will find cheapest transportation on the Pacific ocean, and the Pacific termini of the Trans-Siberian line will be the gateways of import and export for the mining and agricultural regions along the eastern sections of the railway. Such in fact is the case already. The road starting from the Pacific ports as a base was largely built with American machinery and supplies, equipped with American rolling stock, the towns are described as being practically American towns, and the farmers on the Ussuri are using American reapers and plows. It is Manchuria, not Siberia, that is sending flour into the mountains of the upper Amur country.

The Trans-Caspian Railways.—One can see the Trans-Siberian railway in the economic rôle of two different commercial outlets by comparing it with the Trans-Caspian railway in the central Asian provinces. There one-half of a Trans-Asian railway has been made by the extension of the European transportation system to the backbone of Asia—to the mountain wall separating Russian and Chinese Turkestan.

The first link in this chain was the railway connecting Batum on the Black Sea with Baku on the Caspian Sea. Steamers from this point and also the Volga connect with Krasnovodsk on the eastern shore of the Caspian whence the newly completed line passes Merv, Bokhara, Samarkand, and reaches Andijan in farthest Fergana, with branches to Tashkent on the north; on the south to Kushk on the Afghan border. A more direct connection with Russia is the new line from Orenburg, at the end of the Urals, to Tashkent, the northern terminus of the first line.

This is one of the old caravan routes that gave an outlet to central Asia before the Trans-Caspian railway caused it to be almost deserted.

Trans-Caspia, Bokhara, Turkestan, Fergana and Kiwa, the territories served by these new lines, compose an 800-mile stretch of arid and, in part, desert country, irrigated in places by the streams that flow from the high and snow-clad mountains to the east and south. The habitable sections are comparatively small, but fertile. The climate is good, the agricultural products rich and varied. Cotton, cattle, sheep, grains, forage crops, fruits and vegetables of the temperate zone have enabled these oases to support a population as dense as that of agricultural western Europe, and with the coming of the railway, the sluggish caravan trade was quickly succeeded by a lively commerce. The ability to reach the European markets led to an increase of cotton production which now supplies one-fifth of the entire Russian demand. Tashkent and the other cities of the general government of Turkestan are now receiving a part at least of their tea by way of the Suez Canal and the Black Sea. India tea may supplant the Chinese, and a direct route to India may supplant the Black Sea route for this and other commodities. The Trans-Caspian railway has a branch from Merv to Kushk on the Afghan boundary, close to Herat, and separated from it by the easiest pass in the entire mountain system connecting Armenia and Mongolia. On the southern side the railway system of British India has been pushed upward past Quetta on to the Afghan boundary near Kandahar. There are no serious engineering difficulties in the way of connecting the two railroad systems and commerce would be much increased by another radial outlet to the vast landlocked mass of central Asia. Political jealousy is the only reason that the connection between these two national roads now so near together has not been made. They are both military roads, and were not built for economic reasons. Therefore, the caravan still connects India with Russia, and no one can predict how long international jealousy will block the railroad demanded by jostling trade.

Central Asia affords the economic basis for another great railroad—to traverse the Hoang Ho Valley and penetrate the deserts to Hami and Kashgar in eastern or Chinese Turkestan.

This road, which has already reached Sian fu or Singan, would be the eastern counterpart to the Trans-Caucasian and Trans-Caspian lines of Russia; the resources along the route are promising, but the connection with the Russian systems would be improbable, as there are few commercial reasons to make it profitable to surmount a mountain range whose lowest passes are higher than the highest peaks of the Alps. This route from Pekin to Kashgar, followed by camels for thousands of years, passes the coal-fields of the provinces of Shensi and Kansu and the entire route is a promising though unprospected mineral region. In the upper Hoang Ho province of Kansu is the westernmost extension of Chinese agriculture and an important wool-producing region. The habitable part of East Turkestan is a succession of small oases along the foot of the central mountain range, and, like the oases of western Turkestan, depending upon the melting snows for life. Eastern Turkestan[1] is less valuable than west Turkestan, but the second railway has already been built to west Turkestan.

The Routes of Persia.—The improvements in transportation to and beyond the Caspian Sea have profoundly affected the trade routes of Persia. The centers of Persian population, industrial life and trade lie in the north and northwest, where the fertile soil may be irrigated by the snow waters of the lofty Elburz mountains. These districts are reached from India by the Quetta-Meshed caravan route; from the south by the route from Bender Abbas, on the Straits of Ormus; from Bushire and Mohamere, on the Persian Gulf; and from Bagdad, where river steamers deliver cottons, cutlery, fire-arms, tea, and miscellaneous manufactures in exchange for dates, wool, skins, and rugs.[2] From the north, Persia is reached by the Trebizond-Erzerum-Tabriz route, by the routes from the Caspian ports and the

[1] F. Younghusband in his book, *Among the Celestials*, reports that East Turkestan has settlements of from 6,000 to 60,000 people with unused agricultural land and a great abundance of agriculture products, among them wheat, which was cheaper than in India. The total population of Eastern or Chinese Turkestan is probably two or three times that of New Mexico.

[2] The Oriental rug is a nice adjustment to geographical conditions. It is highly valuable and can stand the high cost of long caravan journeys from inland points in west Asia. The wool is furnished by the flocks living on the scanty pasturage of the semiarid lands. The weavers live in densely peopled oases where they divide their time between household manufacture and tilling their irrigated lands.

stations on the Russian railway, which skirts the Persian boundary. A wagon road extends from the Caspian to Teheran, but all others are caravan routes. Those from the south are long, and cross country that is almost desert and has many ranges of mountains. The northern routes are so much shorter and more accessible to rail and water transportation that two-thirds of the Persian trade passes the Russian boundary, and the proportion would be larger if the high Russian transit dues did not compel the English merchants to bring in their goods through the Persian Gulf ports, whence the British government has spent money opening up routes to foster its trade. About 6 per cent. of the trade passes the Turkish boundary, but the general insecurity causes decline of this trade. The strong political influence of Russia in Persia promises to increase rather than diminish the importance of the northern routes in Persian commerce, unless the hand of Russia is palsied by the effect of Japanese reverses and the internal dissensions. A railroad to the Persian Gulf would be the natural outlet for only a part of the Persian territory. It must be remembered that the best of Persia is the northern margin, more easily reached from Batum, by the Trans-Caucasian Railway, from which a branch may soon be built into Persia. Perhaps Teheran lies near enough the trade divide to be served with European and American goods from both a northern and southern railway, as it now is by northern and southern caravan routes. There is, however, no immediate prospect of the building of a railway to the Persian Gulf.

The Anatolian or Bagdad Railway.—The last Asiatic project of importance for international trade is the railway connection between the Persian Gulf and the Mediterranean through a region of wool, dates and minerals. This route was one of the most important international routes in the days of the mediæval caravan trade between Europe and the East, before the discovery of the sea route to India. (See Chapter XII, Part II.) It is now being revived as a railway project, the Bagdad Railway, which, through the enthusiasm of Germany and the subsidies of Turkey, has been already built nearly the whole length of Asia Minor. Already this railroad extends much more than half the way from Constantinople to the navigable part of the Euphrates, which flows through a fertile flood plain, once the seat of mighty

empires, now almost deserted[1] but capable of supporting scores of millions of Asiatics. Since the Turkish Revolution of 1909 extensive irrigation plans have been sanctioned for Mesopotamia and greatly increased trade may, therefore, be expected.

The pious desire of the Mohammedans to visit Mecca has made it for centuries the objection of a vast travel and has resulted in a great railway which, starting at Beirut, passes Damascus and follows parallel to the coast south and southeastward to the Holy City.

The Importance of Southeastern Asia.—The emphasis that has been placed in this discussion upon the long and spectacular caravan routes or the half built and equally imposing railway projects of Siberia, central Asia, Persia, Asia Minor, and Mesopotamia, should not be permitted to cause any one to overlook the fact that the commercial center of gravity of Asia lies in China, Japan, and India and the countries of Indo China lying between them. Vast Siberia and Asia west of the Indus are empty lands, with scarce 50 millions of people. Most of this part of Asia is too dry or too cold for great communities, the exceptions being a strip across Central Siberia and occasional small and scattered areas elsewhere. It is a land in the main much like our arid west, where half the area of the United States has less people than some eastern states. Southeast Asia is soaked in summer by the monsoon rains and there are the crops and the people. In India and southeast of a line running from Calcutta to Harbin in Manchuria live half the people of the entire world. Theirs are the trade routes of a commerce that is to be stupendous. New Chwang, Tientsin, Shanghai, Canton, Hong Kong, Calcutta, and Bombay are the termini of great and growing routes. Fortunately, most of the people tributary to these ports live comparatively near the sea and their trans-

[1] The large and prosperous community, depending upon one irrigation canal for its very life, was a particularly easy victim for the Turk in the exercise of his genius for misrule. The farmer depending upon rainfall had at certain times certain crops that could be taken, but it is reasonably easy to keep enough to save life. The herdsman may get out of sight with his flocks, as the age-long strife of Bedouin and Turk attests, but the band of Turks at the head of the irrigation canal held over the heads of the irrigationists the power of life, death, and all exactions. Hence the desolation and unused possibilities of Mesopotamia.

portation problem is physically simple. The Indian railway net is already well laid, and that of China is begun.

The most important of all Chinese railway lines probably will be the great north and south trunk, which is to connect Pekin and Canton and is already built as far as Hankow, and northward to connect with the Manchurian roads.

Railroads and the New Commerce in China.—In the main the Chinese roads will merely multiply the present trade and industry, not throw them into any revolutionary locations. The revolutions will be in method. The present rapid building of railroads in China promises to bring great industrial and commercial changes, and bring them more rapidly than did the introduction of the factory system in England.

No corner of Asia is without its spectacular routes. Yunnan Fu, the capital of the rich mining province of southwestern China, was reached in April, 1910, by a 450-mile French railway from Haiphong on the Gulf of Tonquin. "The northwestern boundary of Yunnan touches Thibet, thence it goes south and fringes Assam, Burmah, Siam, and Tongking. Across Yunnan are the shortest land routes between the British and French Indies and China. The route from Canton to Calcutta, via Yunnan, is 1,600 miles, compared with 4,000 miles by sea through the Straits of Malacca. To take a longer view, the Yunnan lines will form an important section on the great trunk railway now assuming shape across southern Asia, which will link Canton with the European system at Constantinople, and with that of Africa at Cairo. Of this great trunk railway, fully 5,000 miles in length, about 3,500 miles are either already in operation or under construction; and the greater part of the remainder of the distance has been surveyed and projected.

"The main line of this route, as at present existing, runs from Karachi, on the Arabian Sea, across northern India to Assam. From that point it forks into two branches, both of which impinge upon Yunnan. The more northerly branch reaches Sadiya, on the border where Thibet, China, and Burmah meet, at the point where the Brahmaputra, descending from the heights of Thibet, turns sharply in its course to roll onward through the plains of Bengal. This Sadiya branch is meantime of importance because of the coal fields to which it gives access,

and its continuance into Yunnan would create a connection between the Brahmaputra and the upper navigable waters of China's great river, the Yangtse-kiang—from which Sadiya is less than 400 miles distant—but the other branch referred to is more likely to form the main route through Yunnan to the east. It leaves the existing line about 150 miles north of Mandalay and runs to Bhamo on the Chinese frontier. From Bhamo, or from Kun-lon, on the same frontier, to which a third branch runs from Mandalay, the British government has the right to extend the lines through Yunnan and to the Yangtse."[1]

In 1909 Britain increased her sphere of influence in upper Siam by 17,000 square miles at one sweep, and in consideration thereof arranged for a loan whereby Siam can finance (and the British build) a railway from Bangkok to Singapore. "Bangkok will be on a fair way to be a great railway center. With trains arriving daily from Singapore and Penang on the southern line, from upper Siam on her northern line, and from Saigon on her eastern line, she will have opportunities for becoming one of the great ports of the East."

Chinese railroad building promises to transform Chinese industry so suddenly that it may almost be called a cataclysm. Three or four hundred million people, still mostly in the homespun stage of domestic industry,[2] will in a short time be subjected to the forces that have been gradually applied to the West during a period of one and one-half centuries, at the beginning of which time our populations were scanty. The West has in the main had an industrial evolution. China seems destined to have what we may in all propriety call an industrial revolution.

Following excerpts from *Transportation in Interior China*, by Eliot Blackwelder, in *Journal of Geography*, Nov., 1911, describe the conditions.

"If we look back to the seventeenth century we find our ancestors making use of methods of transportation, manufacture and agriculture which differ only in a minor way from those now used in China. . . . . The horde of junks, large and small, which ply the waters of the canals upon the eastern plains, carry millions of tons, both of native and foreign goods, each year. . . . . . Along the river banks at nearly

[1] From the *National Review*, a Chinese-British publication.

[2] The completeness with which China supplies herself is shown by her imports, which are less than a dollar per person.

all of the large cities of eastern China there is a mass of junks and smaller boats so densely packed that the traveler is moved to wonder how each owner ever finds his own boat. The bare masts make a veritable forest around such great cities as Hankou and Canton. As is well known, these junks are used as permanent habitations by thousands of families who spend most or all of their lives in these movable homes. The internal traffic carried on by means of the junks is enormous in volume but has never been reduced to figures. When the wind blows in the right direction, the skipper of the junk hoists the familiar sail strengthened with bamboo slats. But at other times—and these probably seem to the poor coolie all too numerous—the boat must be dragged or 'tracked' by the crew wearily tugging at the long hawser made of thin twisted strips of bamboo. . . . . .

"On land two vehicles are most in use for both freight and passenger traffic—the cart and the wheelbarrow. The carts are small cumbersome affairs, very heavy in proportion to the loads they carry. This heavy construction has probably been adopted because the roads are so bad that a lighter cart would be shaken to pieces. In western countries local or general governments build and maintain the principal roads, but in China this is not the practice. . . . . . Among the mountains, pack-animals and men afford almost the only means of transportation. Carts are available locally in the broader valleys, but they cannot cross the rugged passes from one valley to another. . . . . . The idea of doing anything for the common good seems utterly foreign to Chinese thinking. Thus it happens that instead of improving roads so that large vehicles may be used and drawn at a fair speed, both the vehicles and the speed are adjusted to the inexorable demands of roads, which are usually as bad as they could possibly be.

"The great popularity of the wheelbarrow in China is probably due to the fact that a vehicle with one wheel can more easily take advantage of the best parts of the road than one with two; furthermore, it requires no draft animals. The freight-barrow used by the Chinese has a capacity of 600 to 800 pounds, and, like the cart, is a very stout, heavy machine. It is made of wood throughout. There is no more characteristic noise in China than the incessant squeak which arises from the ungreased axles of the wheelbarrows in town and country. The barrow is not always a one-man vehicle; often a donkey or a mule is hitched to the front of it, after the manner of a plow; and when the wind is favorable the thrifty coolie not infrequently rigs a sail to aid him in his weary struggle with a load which always seems much too big for him. . . . .

"There are coal mines in Shan-tung (one of the eastern provinces) whose entire output goes by wheelbarrow to cities and towns 50 to 100

miles away. In the case of coal, the rapid increase of the freight charges limits the sale to a small district. More valuable commodities are often carried much farther . . . . . low grade commodities such as coal, building stone and grain, cannot now be carried any great distance from their sources, on account of the excessive expense of coolie and cart traffic. . . . . . In 1900 a severe drought destroyed the crops in Shen-si province and soon reduced 3 million people to starvation. More than a third of these actually perished for want of food. And yet, at the same time, bountiful harvests were gathered in the eastern and southern provinces. . . . . . The coal from Shan-si, carried on donkeys or coolies, is doubled in price every 15 or 20 miles, and so can have only a local market. For this reason one sees the peasants of the great Yellow river plain burning corn-stalks for fuel in their cooking stoves and making no pretense of heating their houses during winter. Coal is beyond their reach now, but with railroads they might have an ample supply at $2 or $3 per ton. . . . . . The railroad will not drive out entirely the cart and the barrow, the donkey and the coolie-porter. It will merely supersede them in long-distance hauling."

Some observers predict that the next twenty-five years will see more railroad building in China than in all the rest of the world put together.[1] This will give rate wars and the freight advantages of competitive points. This is the force that has done more than all else to pile up western populations in unwieldy cities, separate them from their food supplies, and increase the cost of living. The Chinaman who can live by the household system on his patch of ground, will, like the New England farmer, often find that he cannot do so if he goes over to commercial agriculture with its freight charges and the limitations of crops to those that can be shipped. Yet China is getting railroads apace, the railroads make freight differentials, the freight differentials make cities, and the cities increase the cost of living by inflicting wastes which the richer West is with difficulty able to endure. The suddenness of these changes will make them harder to endure, especially as they will begin on a people with such a low standard of wages and such an undeveloped sense of united action for the common good. The Shanghai flour industry,

[1] At the end of 1911 there were in China proper 5500 miles of railway in operation and 2800 miles of trunk line under construction. Dr. Sun Yat Sen hopes to be instrumental in building 60,000 miles of railway in the next 10 years.

that rises as the railroad epoch opens, is a good example of the speed of the changes. In 1899 this city shipped 130 barrels of domestic flour up the coast. In 1909 the shipments reached a million barrels. Its price was from 10 to 33 per cent cheaper than that from the United States, and the American flour import to China and Hong Kong fell from 2,800,000 barrels in 1907 to 1,300,000 barrels in 1911. The German railroad in Shantung is bringing increasing shipments of wheat out of that province and the northern railways are advancing toward Shansi where (in the region where millions know not the taste of rice) large areas were in wheat worth locally twenty-five to thirty cents (American) per bushel. It is easy to see how the railroad will raise the price of that wheat to world level, stimulate its production and increase the price of commodities and the cost of living.

The recent revolution in China is a result of the determination of the many progressive Chinese to adopt western industrial methods. The most potent sign of this change is the railroad. The Great North and South trunk route from Pekin to Canton has already passed Hankow on the Yangtse, which river is now accessible from Europe by rail. From Ichang, at the foot of the rapids of the Yangtse, a line is under construction toward populous, fertile and coal-rich Szechwan. In the spring of 1911 30,000 men were working on this line (U. S. Con. Rep., May 20, 1911). Of more immediate promise even than the new railroads is the general adoption of *native-built* motor boats for the canal and river traffic on the available waters of all parts of China.

When the hundreds of millions of Chinese, by the aid of western teachers and by the use of western devices, are enabled to get at their wonderful resources, utilize and transport them, very surprising trade readjustments will follow, and China will enter an era of industrial and social problems more pressing than any nation has yet experienced. With the factory comes unemployment, a new thing of which the Chinese are already beginning to complain.

Transportation in Japan.—Japan has had an unusual opportunity to develop transportation—a string of narrow islands with rugged interiors, that force the people to live near the coast, and the coast well supplied with harbors suitable for the much-used

coasting vessels. This ease of communication aids in the quick spread of western knowledge, and the transformation of Japan therefore preceded that of China. Most of the important places are connected by railroads which connect with the old transport facilities of the densely peopled orient, which consisted in 1908 of 166,000 Jinrickshas (number declining), 35,000 ox carts (number increasing), 126,000 horse carts (number increasing), 1,488,000 coolie carts (number increasing).

CHAPTER VII

THE MEDITERRANEAN-ASIATIC ROUTE

The Lands and People Served by This Route.—This grea trade route connecting America and Europe with Asia by wa of the Mediterranean and Red Seas is the route through th heart of the world. It passes through the heart of the worl in several senses: First, in point of land mass served by i The world is often shown divided into two hemispheres, one o which is called the land hemisphere, with its center in wester Europe and including practically all of the eastern hemispher except Australia and nearly all of the western hemisphere The major parts of this land hemisphere are connected throug their midst by this great route and its main ramifications. An examination of the globe shows how great a part of the worl it reaches. Asia itself comprises more than a third of the lan surface of the earth. With Europe and Africa, which are a par of the same land mass, it comprises much more than half of th earth's land; and by one of the fortunate circumstances o geography, this route pierces the middle of this land hemispher and practically circumnavigates the vast irregular continent sometimes called Eurasia—much the greatest block of land in the world—and receives branches from all of the numerou indentations that cut its southern shore. The vast size and mountainous interior of these lands reduce land transportation t insignificant proportions and turn all traffic toward the sea.

In a second respect this route may be said to pierce the hear of the world, because it reaches lands containing most of th world's population. For Asia the total is nearly 800 million; fo Europe it is 370 million; for Atlantic North America it is over 7 million, and Africa contributes enough to raise the total of th people served by this route to over 1,200,000,000—an astoundi figure. The total population of the world is about 1,600,000,00 so that the Mediterranean-Asiatic route serves more than thre

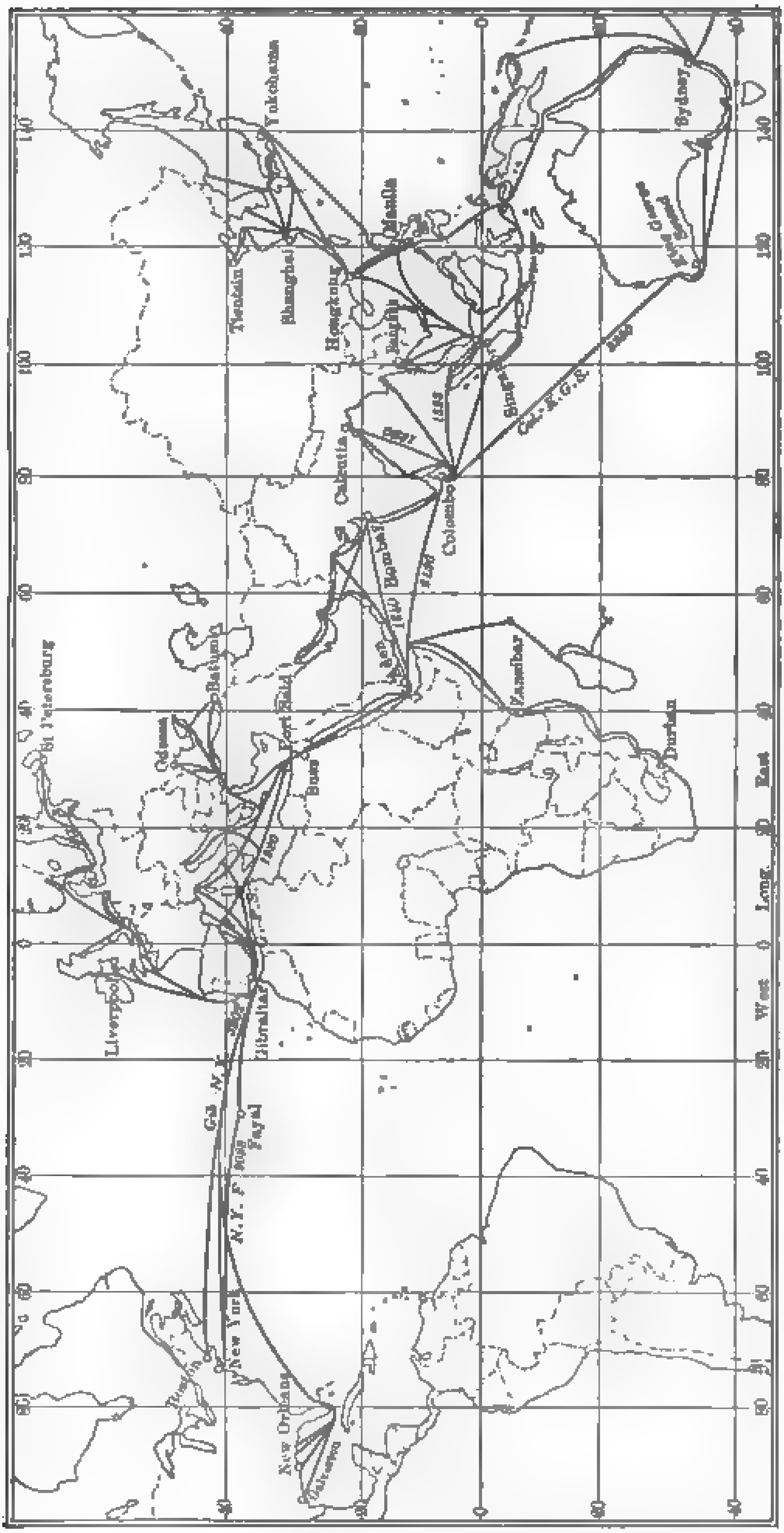


FIG. 232.—Mediterranean Asiatic Route.

fourths of the world's inhabitants. The only large masses of population that are not reached are the savages of Africa and the forty odd millions of South Americans, so that the Mediterranean-Asiatic route not only reaches the major part of the world's people, but a still greater proportion of the world's civilized people. It connects the two great types of Western civilization, as represented by Europe and America, and the Orient, with its older civilizations of India, China, and Japan. Along the route is found every stage of industry from the most complicated and mechanical in America and Europe or the most elaborate hand manufactures of India and the Orient, to the crudest producers of crude raw materials such as the salt gatherers on desert coasts.

History of This Route and Its Trade.—The route, in that it includes an artificial ship passage from the Mediterranean to the East, is a creation of the most modern civilization; but the trade is older than the Pharaohs, for the trade is that between the West and the East, regions which have, since before the dawn of history, differed as they do now in the general conditions of life and production. The silks, perfumes, spices, and other costly products of the tropics and of Asiatic skilled hand labor have for fifty centuries come out of the Far East and sought Europe. This destination has been reached over a multitude of routes from the Trans-Siberian sledge route in the frozen north to the galleons which rounded the Cape of Good Hope. Between these two extremes the route of this traffic has shifted, and with every shift it has made a new epoch in history. There were times when it came to the north of the Caspian Sea, through south Russia and Poland into east Germany; again it sought the same route to the Caspian and passed into western Europe through the Danube Valley. For a time it went to the south of the Black Sea across the Bosporus and made Constantinople the commercial mistress of Europe. A yet more southern route is that connecting the Persian Gulf and the northeastern end of the Mediterranean where the city of Antioch grew into prominence. In the sixth century it made great the desert cities of Baalbeck and Palmyra. The region around Suez has had its share of the traffic in ancient times. Caravans have sometimes crossed the short Isthmus of Suez; at other periods they have even reached the Nile Valley below Cairo. From 1500 to 1840

nearly all of this traffic passed around Africa in sailing vessels. About the middle of the nineteenth century the Peninsular & Oriental Steamship Line had its origin in steam services which gave a mail route from England to India through the aid of separate lines of steamers running from Great Britain to Egypt and from India up the Red Sea to Port Said. The portage where the Suez Canal gives a through passage was then a busy place. At times 3,000 camels were employed to carry a $2,000,000 cargo of a single steamer across the isthmus.

The opening of the canal in 1869 made a great revolution in trade; not only in the route it could follow, but in the type of vessels to be used. Because of the uncertain and weak winds of the Mediterranean and the yet more uncertain winds of the narrow, rocky, and dangerous Red Sea, these waters have ever been closed to the sailing vessel that would pass from the Indian to the Atlantic Ocean. In 1870 the opening of the canal, therefore, meant a new route and a new type of vessel, for before that time the long route around Africa was closed to the steamer, and the new vessels had to be built for the Suez Canal which was closed to the sailer. This caused the traffic to rise slowly at first, but it has, however, risen steadily, and has now reached enormous proportions, so that the canal company which was at first ridiculed as a hopeless investment has become one of the best dividend payers in the world.

The Supply and Distribution of Fuel along the Route.—The Mediterranean-Asiatic Route is admirably supplied with coaling stations for the vessels that follow it and is fairly well supplied with coal. The route may properly be described as being double at both ends. In the West it has its main feeders in Europe, but an important part also on the Atlantic coasts of America. In the East, after rounding the continent of Asia, the greater division turns to the northwest toward China and Japan, while another and smaller branch goes to the southeast to serve Australia. There are coal fields at each of the four termini—eastern United States, Great Britain, Japan, and Australia, but the middle part with its thousands of miles of length is peculiarly barren of coal. Australia sends coal at times to every shore of the Pacific (including California), and Singapore at the southern end of the Malay peninsula is supplied with both

Australian and Japanese coal. A little is also sent thither from the meager production of Bengal, and occasional cargoes of Welsh coal reach that distant point. All coal ports from Colombo, Ceylon, westward are regularly supplied from the fields of Wales. The price of coal at these ports bears little relation to the distance that the ports may happen to be from the source of the coal. This arises from the fact that as the tramp steamers carry the coal from Wales to the coal port, the rate is decided not by a consideration of mere distance but by the prospect of obtaining a profitable cargo when the coal is discharged. Consequently, coal is cheap near good sources of freight and it is high when freight promises to be scarce. It thus happens that although the distance from the coal fields is twice as great, coal at the eastern end of the Mediterranean is little, if any, higher than at the western end because the western end of the Mediterranean produces little freight of the kind that is shipped as full cargoes in the tramp steamers, while the eastern end, with Egypt and particularly the Black Sea with its millions of tons of export grain, produces such freight in great abundance, so that the coal vessel discharging at Port Said is nearer another cargo giving profitable employment than is a vessel discharging at Gibraltar or Algiers. Consequently Port Said is a coaling station of greater importance for commercial ships than any other one port in the Mediterranean, although Gibraltar and Algiers are important stations and Malta is sometimes used. Aden, which lies exactly on the route at a very convenient place for the taking on of coal, has the misfortune to lie between two deserts producing little but salt, so that the coal at this point is high, and as a coaling station it is only used by those vessels which are compelled to do so. The next coal station, and one also of admirable location, is Colombo on the southwest shores of Ceylon on the road toward the Malay Peninsula, the point of Asia which all ships to the Orient must round. Exactly on this point is Singapore, a port of admirable location for a coaling station and also with cheap coal supply, due to the fact that comparatively near it lie the rice ports of Burmah and the sugar ports of Java and the Philippines, so that vessels coming with coal from Australia, from Japan, from India, and even from Wales have excellent opportunities to secure return cargo.

It is interesting to note that this port of Singapore is purely a creation of the present Mediterranean-Asiatic route. In the sailing vessel days that strait was of little importance. The vessels from India sailed south across the Indian Ocean; those from China and Japan came down the China Sea and through the Sunda straits separating Java and Sumatra. Under these conditions of ocean transportation the straits of Sunda were the gateway to east Asia, and Batavia, lying almost at the mouth of the strait, was the great port. With the coming of the steamer passing westward to the Suez route, all this was changed and the Strait of Malacca, between Sumatra and the Malay Peninsula, became the gateway to the Far East. Nearly a century ago a British subject who could foresee the future had the daring to calmly seize the then unsettled island of Singapore which guarded this passage and then await instructions from home. His commercial and strategic foresight have been well indicated by the progress of the last half century, which has made a great port on this island, and put the naval officer's statue in the central square which bears his name. During this time the port has become the greatest port of the region, a great British fortress, and a great commercial coaling station.

Other coaling stations of importance are Hongkong and Shanghai, conveniently situated on the Chinese shores.

There is no iron-clad rule by which a shipowner decides the actual coaling practice to be followed by the captains of his ships because it becomes a new business question with each voyage. If the ship can make its owner more money carrying much freight and little coal, it will do so and stop at frequent intervals for more coal. If such stopping is desired no long route in the world equals this one for coaling opportunities. A vessel can sail over it from the remotest port in the Gulf of Mexico to ice-bound Vladivostok in east Siberia without ever being compelled to carry coal for a voyage longer than that between Aden and Colombo, a distance of less than 2,200 miles. The vessel from the Mexican Gulf, if it so desired, could get coal at Havana, Norfolk, or Bermuda; the vessels from New York occasionally in times of great stress of freight and high rates call at Fayal or St. Michaels in the Azores about 2,000 miles out from New York, and thence onward the succession of ports is continuous.

The leading ones actually used by the various lines are Gibraltar, Algiers, Port Said, Aden, Colombo, Singapore, Hongkong, Shanghai, and Yokohama or Moji.

The coaling question may sometimes assume another aspect to the shipowner. If freight rates are low and the amount of freight scanty, for the two usually go together, the cost of stopping at coaling ports may make it unprofitable. In every case there are port dues to pay, usually a high price for coal; there is always loss of time, and usually quarantine expenses, pilotage, and the possibility of quarantine delay. For these costs there are in times of low freights no compensating returns. and it will therefore pay the steamer to carry as much coal as possible from the original port, as in cases where vessels are known to have steamed without stop from Great Britain to Japan. This is, however, unusual, although the reduction of the stops to two, one each at Singapore and Port Said, the best ports, is not uncommon.

The fuel supply for this route in the near future may be considerably modified. At present the abundant coal supply of China is not mined enough for export and the steamers are using inferior Japanese coal in Chinese ports. It is probable that the magnificent supply of the Celestial Empire may in the near future materially alter the coal supply of Oriental ports. Another change of much greater possible extent may come about through the use of oil as a fuel for steamers. It has many advantages and is beyond the experimental stage. If it should become the general practice of ocean vessels to use this fuel, the Mediterranean-Asiatic route is particularly well supplied with oil. Eastern America produces about a third of the world's supply and supplies western Europe. The rich oil fields of the Caspian Sea produce about as much as eastern United States and the point of shipment at Batum on the Black Sea is adjacent to and midway along the route. Very promising fields are being developed toward the other end of the route in Burma, Sumatra, and Borneo. It is also fairly well established that there are great oil resources in China.

A Trunk Route.—Of all the world's ocean routes the Mediterranean-Asiatic is the trunk line par excellence. This comes about from its length and its location between the two northern

and the two southern continents of the eastern hemisphere, which it serves by numerous lateral branches, finally reaching in the west the United States, where its termini include the widely separated points of Galveston and Boston. The indented coasts of Europe and Asia furnish from every great gulf and sea a branch to the main trunk route. In this respect it is quite the peer of any railroad system and in its structure bears considerable resemblance to the Pennsylvania Railroad—probably the best located railroad with regard to traffic in the whole world.

Traffic.—The traffic upon this great route, which almost circumnavigates the world, is as varied as the peoples and lands which it reaches. For convenience the traffic may be considered in six different groups. While two of these groups are confined to a single continent each, and in that respect have certain local aspects, their trade is international.

First—The Traffic of the Mediterranean Waters.—The Mediterranean itself is about 2,000 miles long; and, including the Black Sea, it is nearly 3,000 miles from Gibraltar to the most remote indentations of the Russian Empire. This may properly be called the most magnificent system of inland waterways in the world. Its waters give ocean transport to ten independent countries and many colonies. Through the navigable rivers of south Russia and the Great Danube, it reaches far into the heart of Europe. From prehistoric times it has been the scene of busy commerce. Before the days of the compass its many islands favored navigation from landhead to landhead and it is thus possible to traverse its whole length with reasonable safety by keeping in sight of land. In the present epoch of steamers it is busier than ever. A good example of this is the great Italian Steamship Co., which possesses over 100 steamers and serves no less than seventy-eight ports on the Mediterranean system. These disbursers of Italian produce and collectors of Mediterranean goods gather products at Genoa and Naples to be sent across the Atlantic in ocean steamers belonging to the same company. This is a common system in European commerce and in the Mediterranean. It is also done by the French lines assembling at Marseilles; by Austrian lines assembling at Triest; and, to a lesser degree, by the Spanish, the Hungarian, and the Russian steamship companies.

This Mediterranean traffic is between two distinct economic districts—a food-importing district and a food-exporting district. While Italy, France, and Spain are great agricultural countries, they are also manufacturing countries and must import both food and raw materials. The east Mediterranean region, comprising Hungary, which reaches navigation at Fiume on the Adriatic and at the river ports on the lower Danube, the Balkan states, Turkey, and Russia, is essentially in the raw material producing stage. Grain and other agricultural products are the chief exports, and to these, the east end of the Black Sea adds ores and the vast petroleum exports of Batum. This gives the basis for a lively exchange of manufactures from the west for the wheat, corn, rye, oats, and oil of the east Mediterranean.

Second—Traffic between Western Europe and the Mediterranean.—Great Britain and the other countries adjacent to the North Sea use great quantities of the sub-tropical orchard and garden produce grown along the shores of the Mediterranean proper, from Spain to Asia Minor inclusive. Chief among these products are wine, oranges, lemons, figs, raisins, and early vegetables. These edibles in great quantities go to the northwestern countries, and the heavy populations of the manufacturing districts adjacent to the North Sea also use large quantities of the grain, ore, and other raw products from the Balkan and Black Sea region. The return cargoes in this trade consist in point of bulk primarily of coal of which over 20 million tons a year pass from the Welsh fields to the Mediterranean ports. The next in bulk are the forest products of Scandinavia which are in great demand in the populous and essentially timberless Mediterranean. In point of value these bulky articles are rivaled by the machinery, cottons, and other manufactures of Great Britain, Belgium, and Germany.

Third—The Traffic between the East Indies and the Orient.—The term East Indies—following the British classification—includes India itself, the mainland to China; also Singapore and the adjacent islands. Here is a large traffic and one which promises to continue its growth, for it has a firm basis in economic conditions. Japan has become a rapidly increasing importer of food and raw materials. Chief among these imports are cotton, rice, and sugar, all of which are produced in south Asia;

the cotton in Hindustan; the rice in Burmah, Siam, and Indo-China; the sugar in Java, the Philippines and other scattering localities. In return for these commodities Japan sends coal as far as Singapore and some manufactured goods to all the countries mentioned. As Japan increases in industry, and China with her vast populations follows in her wake, this trade between temperate Asia and tropic Asia promises to largely increase.

Fourth—Traffic between North America and the Mediterranean.—This is, in its present routes, a new trade. There was a time not long ago when direct steamer lines from north Europe to America took from Europe the products of all parts of the world, including the Mediterranean. To a limited extent this practice of trans-shipping at Liverpool or London the products of Italy, Spain, Greece, and Turkey, still continues, although between 1890 and 1912 it has been greatly modified by the establishment of new lines of steamers between New York and Marseilles, Genoa and Naples. The process has gone even further and the desire for direct shipment has caused lines to be established between New York and Constantinople and the Black Sea, thus avoiding the trans-shipment of eastern Mediterranean goods at western Mediterranean ports, and thus carrying one step further the universal desire for direct communication between producer and consumer. It is natural that an essentially agricultural country like the United States should have much more trade with the manufacturing countries of the western Mediterranean than with the agricultural Black Sea region, although we send at times large shipments of agricultural machinery to the Black Sea ports.

Fifth—Traffic between Europe and the East.—This is really the first and greatest of them all. In its beginning and down to comparatively modern times this trade was chiefly an exchange of European bullion for the silks and other luxuries of the East. The easy transportation of the steamship era has added to it commodities which before were unthought of. The region of the Persian Gulf now sends to Europe dates, wool, and hides, as well as Mohammedan prayer rugs. The port of Karachi in northwestern India is famous for the shipment of wheat and grain grown in the valley of Indus to the north of it. Beyond is Bombay, which sends to Europe cotton, wheat and a great

variety of oil seeds from which are extracted scores of the higher grades of oil known in the paint and drug trades. Beyond is Colombo in Ceylon, which along with Calcutta, has of late years begun to export tea. From Calcutta also comes the world's supply of jute shipped chiefly to Dundee for the manufacture of gunny-sacks to be used throughout the world. Indo-China, which may for this purpose be considered to include Burmah, also has its staple export—rice, which is sent in shiploads to all parts of the world, especially to Bremen and London, the great rice markets. Singapore continues the properly oriental characteristic of being a great spice center and being the junction point for many small steamship lines. It has an import and export trade of $500,000,000 a year, greater than that of many nations. From Java come annually about a million tons of sugar. The Philippines send sugar and tobacco. China and Japan are the main factors in the world's supply of raw silks and join India in competing in the tea supply. Chinese and Japanese matting, curios, and vegetable oils and extracts practically complete the export trade of these two countries.

In return for this varied supply of raw materials and peculiar manufactures, western Europe (chiefly England) is sending railroad iron, locomotives, all kinds of machinery, cotton goods, clothing, preserved foods, and manufactures and supplies in innumerable variety.

Reference should be made here to the small traffic on the three subsidized colonial mail routes that branch off to the southward. From Aden the German East Africa line goes down the African coast; and a French subsidized line leads to Madagascar, Reunion, and Mauritius. From Colombo a British mail line goes to west Australia; and from Singapore a German Colonial Line traverses the archipelagoes to the meager and unwholesome settlements in Germany's East Indian colonies and to the north coast of Australia.

Sixth—Traffic between North America and East Asia.—This was, until a very recent date, very much like the trade from the Mediterranean in that little of it was handled by vessels passing directly between the trading countries. London was the great market from which we received the products of all Asia, and the returning European vessels carried some American goods,

although much of the American supply of goods imported from Asia is paid for with European manufactures, which in their turn are paid for by our exports to Europe. About 1900 direct lines of steamers were established between New York, India, China, and Japan. The experiment was instantly successful and the lines have continued, with the addition of others from the Gulf ports. These vessels carry cotton, petroleum, wood, and iron manufactures, tobacco, cotton cloth, and miscellaneous manufactures. Petroleum alone is so much prized by the Chinese that it fills quite the half of all the shipping that goes from the United States to that Empire. The return cargo is much less bulky and many of these vessels return with Philippine hemp, Java sugar or East Indian rice. This traffic, unlike most of the others enumerated before, has no great future over this route because of its almost certain diversion to the Panama Canal route when that great waterway is completed.

CHAPTER VIII

THE NORTH PACIFIC ROUTE

The Commercial Newness of the Pacific.—The Pacific Ocean is the last of the great oceans to become of interest to the world at large. The Atlantic and the Indian have been repeatedly traversed by the representatives of western civilization since the year 1500, but during three-fourths of the period that has elapsed since that date the Pacific has remained a region unknown; and to this day there are in its vast expanse many uncharted islands. When the eastern coast of North America had already produced commonwealths strong enough to declare their independence, the central Pacific was just being explored by its first great navigator, Captain Cook, who lost his life there at the hands of the savages who had never before seen a white man. About 1806 Oregon received its first white settlement, but as late as 1840 a man well-informed for his time stood up in the United States Senate and ridiculed the idea that the Pacific coast of the United States could ever be of value. It is from the middle of the nineteenth century onward that the Pacific has risen swiftly to the important place it now holds in the attention of the civilized world. In 1848 came the gold discoveries in California and the making of a new commonwealth there promptly followed. Three years after the California discoveries the gold cry went up from Australia and there was a rush to that corner of the Pacific. In 1854 the ports of Japan were opened to the world; fifteen years later our first trans-continental railway was completed to the Pacific coast; and throughout the last fifty years we have had continual interest in the north Pacific fisheries.

Since 1890 the intensity of interest in the Pacific has increased. In 1894 came the Japanese-Chinese War, which signified that there was an Asiatic power. In 1897 the Alaska gold discoveries placed emphasis on yet another point. Upon the first of

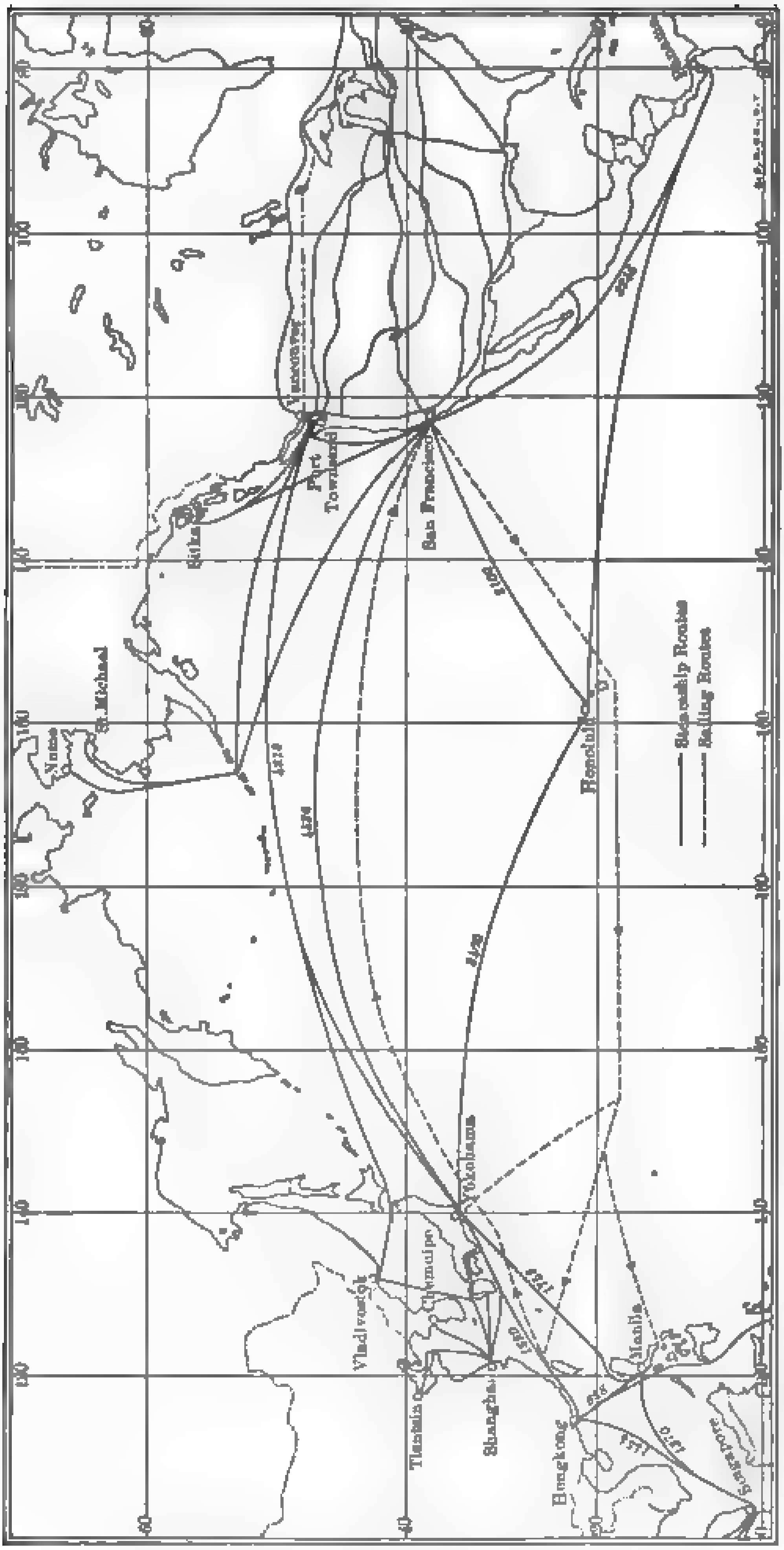


FIG. 233.—Routes of the North Pacific.

May, 1898, Dewey's guns announced from Manila to the American world that there were such things as the Philippine Islands. We have annexed Hawaii, have watched the Russian advance to the Pacific, and have joined the world in amazement at the recent Russian defeat at the hands of Japan. Meantime, all the leading powers of Europe have been striving to gain a foothold in China, the mysterious Celestial Empire that has proved so inviting to the exploiting and trading nations; and the United States has been digging away at the American isthmus to get a new gateway to the great Pacific.

The Steamer Tracks.—All this recent interest centers around regions which are directly connected with the north Pacific trade route. This route is like the north Atlantic route in that the great circle factor is of much importance in locating it, and widely separated regions are brought by the factors of geography to use one and the same great route. The great circle factor is of much greater importance on the Pacific than on the Atlantic, because the regions of importance upon the two ends of the route are in virtually the same latitude, the distance is so much greater that the amount of the northern deviation of the great circle line is consequently increased. There is no part of the world upon which the mercator map works greater distortion. The American-Asiatic cable route via the mid-Pacific islands of Hawaii and Guam to Manila is far from the direct line, but was so placed to be on American soil. Instead of America and Asia facing each other acróss a wide ocean, a globe shows that the west shores of America and the east shores of Asia are practically a continuous straight line. The effect of this upon trade routes revolutionizes the ideas which one must get from looking at a flat map. The steamer that attempts to pass directly from the ports of Puget Sound to Yokohama will wreck herself upon the rocky shores of the barren Aleutian Islands. Consequently the route is not a true great circle, but is flattened out to the southward from it, so that the vessels may avoid the Aleutian Islands, in sight of which they pass. From San Francisco it is possible for the vessels to make a true great circle up near the Aleutian Islands. The effect of the great circle becomes yet more perplexing when the attempt is made to apply it to the route from Panama to

Yokohama. The direct line between these two points goes northwestwardly through the Caribbean Sea, Yucatan, the Gulf of Mexico, Texas, Wyoming, Vancouver's Island, the Alaska peninsula and thence southward to Japan. A steamer compromising with these hard facts skirts the shores of the American continent until southern California is reached, and then across the north Pacific Ocean in the latitude of southern Canada. San Francisco is therefore much more nearly upon the actual short route from Panama to Yokohama than is Hawaii, which we are accustomed to think of as being exactly in the path. To stop at San Francisco would require a deviation of but 114 miles from the shortest possible path and the deviation to Hawaii is over 300 miles. The one point that commercially commands the north Pacific route is the main island of Japan, for upon it is the great port of Yokohama, where practically every vessel crossing the north Pacific stops. Here every thread of this great commercial cable is focused to a single point. This spot is exactly on the route and is a great coaling station, being thousands of miles from any other port to the eastward which can have rendered service to the steamer. Manila is the last port of call for the steamers passing between Asia and America; Yokohama is directly on the route to it; and the Chinese ports of Hongkong and Shanghai are almost invariably sought by the same steamers on the out voyage.

Owing to the storms of winter there are times when vessels do not go so far north as in summer, but they do not go far enough south to prevent their reaching Yokohoma as their first port. The importance of the trade of the Hawaiian Islands causes the port of Honolulu to be visited en route by the three steamer lines making for the port of San Francisco, although this detour costs these vessels about 800 additional miles of steaming. The vessels from Puget Sound to Asia do not touch Hawaii.

Coal Supply and Winds.—Upon most of the great trade routes there has been a sailing-vessel epoch, which has been gradually giving way to the advance of the steamer. There has been less of this upon the north Pacific than upon any of the other great routes, chiefly because the traffic has largely arisen since the epoch of the steamship, and, furthermore, because it is essentially steamer rather than sailing-vessel traffic. This

part of the ocean, however, is well supplied with the natural conditions for sailing vessels. North of latitude 35° there is a good westerly wind bringing them steadily eastward from Asia. The vessel crossing to the westward beats southward immediately upon leaving an American port; and when the trade-wind zone is reached, turns westward and sails before this wind for thousands of miles until near the coast of Asia; then a deviation may be made to reach the desired ports.

The coal supply upon the route is fairly satisfactory, but the great length of the voyage requires that a steamer shall give up a comparatively large proportion of her space for coal purposes. There is practically none taken en route. Fortunately the Japanese coal, lying as it does part way between Asia and America, is admirably located. A vessel a thousand miles out from the Chinese coast takes on Japanese coal very close to the point of its production. Unfortunately there is no satisfactory supply thus far in California, and most of the American coal comes from the region adjacent to Puget Sound. Some Japanese and more Australian coal is imported at San Francisco, and cargoes in sailing vessels regularly come around the Horn from Atlantic ports of America and occasionally from Wales. Hawaii is generally thought of as a coaling station of prime importance. With its large exports of sugar it has the trade condition for furnishing export cargo for the coal carrying ship. Coal is brought in large quantities from Australia and the other coal sources just mentioned, but strange to say it is not the practice of the steamship lines to take coal at this point. The lines from Puget Sound which pass within sight of the Aleutian Islands also make no stops for coal, although there are harbors quite close to the route.

Traffic.—The first part of the north Pacific route to attain modern importance was the link between Panama and San Francisco in the early days of the gold epoch in California. Many thousands of men engaged in producing nothing but the precious metal of coinage required a relatively great movement of commodities to supply their every want. For a time the returns of gold production were so great that it paid to produce nothing in California, but import everything from other parts of the world. While the pioneers crossed the continent in

stage coaches and wagon trains, sailing vessels flocked around Cape Horn with supplies, but this route was so slow and so long that means of communication across the Isthmus of Panama were promptly established; and steamship lines were running from San Francisco to Panama and Nicaragua several years before the opening of the Panama Railway in 1856. These lines connected by overland wagon routes with steamship lines to New York. Over this route there was a lively trade, which increased steadily until the completion of the Union Pacific in 1869 reduced its importance by getting a quicker railway communication with the eastern centers of population. Despite the activity of many trans-continental roads the steamers upon the isthmian route are still running.

The north Pacific route has rendered its greatest service as a new road between the West and the East—a new rival to the old routes across Asia, around Good Hope and through Suez. Before the first trans-continental railway was opened in 1869 there was a steamer line from San Francisco to Japan and China. This original line has been followed by a half dozen more. These numerous steamers, which are among the largest in the world, carry outward a much greater amount of cargo than they bring on the return voyage from Asia. A comparison of staples easily explains the reason. America exports coarse cotton cloth and gets silks in return; coarse lumber is exchanged for lacquerware, raw cotton for silk, canned goods and flour for drugs and essential oils, heavy machinery and petroleum for matting, Oriental art goods, and fire crackers.

This lack of freightage balance upon this trade route has led to some peculiar movements. An European vessel coming out to China and Japan is in a sad plight for return cargo, so that many of the sailing vessels which go to China and Japan from the north Atlantic have discharged their cargoes (chiefly oil) in the Oriental port, crossed the north Pacific in ballast and returned to the north Atlantic with a cargo of grain secured at Puget Sound, Portland, or San Francisco Bay. Owing to the prodigious distance of this sail from San Francisco, there have rarely been times when steam tramp vessels could with profit carry these grain cargoes, although they have at times made the voyage. Within the past few years, British line steamers have

continued their voyage from Great Britain to Japan across the Pacific to Puget Sound, loading there with grain and other American produce, which is taken to Liverpool by way of China, Japan and the Suez Canal. The Hamburg-American Company also plans to put a line of vessels on this same route from Hongkong.

Hawaiian Traffic.—Hawaii has a place in the traffic of this route much greater than her area would indicate. It is a small island best fitted to produce one thing which is exchanged for the great variety of commodities now necessary to supply the wants of civilized man. The Hawaiian staple is sugar, which has reached quantities exceeding 500,000 tons a year. Most of this went around the Horn until the opening of the Tehuantepec Railway. Much of it goes to the port of Philadelphia, although some of it goes to the nearby ports of the Pacific mainland, which are also importing bananas, pineapples, and other tropical fruits from these islands. The frequent service from San Francisco gives that city an even greater importance as a base of Hawaiian supply than as a market for Hawaiian goods.

Alaskan Traffic.—To the northward there is an additional stream of traffic. The discovery of gold in Alaska set up a lively traffic with the north. These vessels pass both from San Francisco and Puget Sound, although the latter, because of its nearness, has a larger trade and a route which lies largely within the shelter of the archipelagoes that skirt the shores in this region. The chief Alaskan ports of Juneau and Skagway are located on the mainland not far from Sitka. The new White Horse Railway gives quick connection with the upper end of the great inland navigation system of the Yukon, which is the one thoroughfare to both British and American gold fields. This same Alaskan thoroughfare is reached at its Bering Sea end by steamers which leave the north Pacific route at Unalaska Island, where the vessels turn northward into the Bering Sea. This route is also followed by a considerable number of whalers having their headquarters usually at San Francisco, but sometimes at a Massachusetts port. Another interesting bit of traffic is that arising from the salmon fisheries which dot the American coast from the mouth of the Columbia River to Bering Sea.

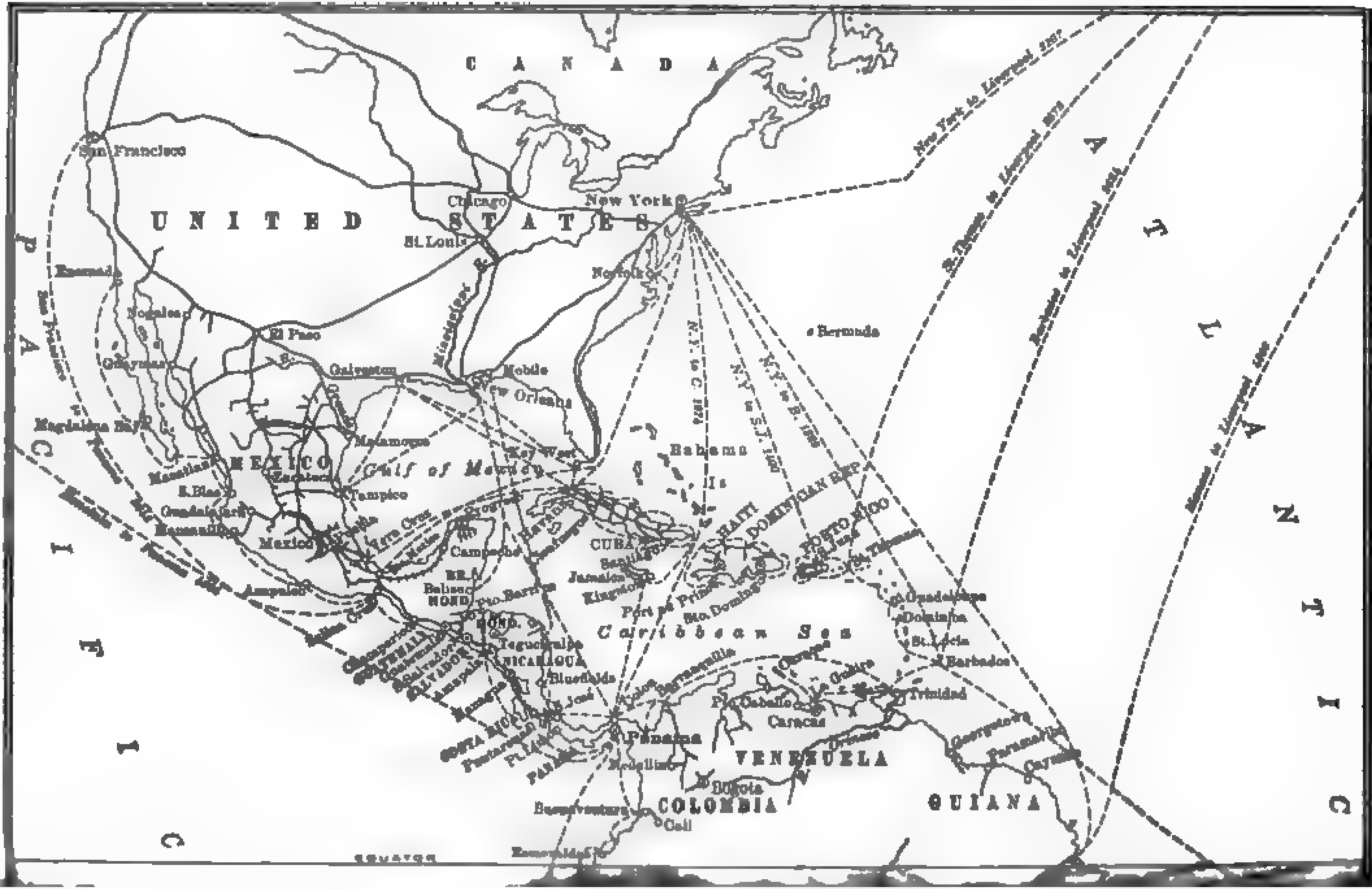
Prospective Traffic.—The prospects of traffic along the north Pacific route are for great increase. Every region adjacent to it is, in the modern sense, in its economic infancy. With their development will come trade. Japan is just entering upon a manufacturing epoch in which, like England, she must import both food and raw materials. There has already been a large trade over this route in carrying to Japan the machinery necessary for the development of these industries. This traffic will continue, with, of course, changes in the number and character of the commodities comprising it. Manchuria is the one underpopulated part of east Asia, and adjacent to it are over 300 million Chinese who have lived thus far by agriculture and household industries in a region whose coal and other mineral resources are probably unexcelled. Any such industrial awakening on the part of its people must mean enormous traffic over this route.

There is also every indication that the mineral resources of Alaska are of large extent. Our rising interest in distant places, and our abundant capital are going to make industries in this partly explored land, where for a considerable period to come there will be little produced but minerals, and consequently an enormous import of machinery and other supplies from the South. All these will pass for hundreds or thousands of miles over a part of the north Pacific route. It is generally recognized throughout the United States that the whole Pacific coast region of this country and British Columbia is capable of great development. The growth of trans-continental railways to connect it with the East has completely reversed the prophets of the sixties, who asserted that the heavily subsidized Union & Central Pacific Railway would never have sufficient traffic to make it pay. The rapid increase of these lines can be taken as a prophecy for Pacific trade, for every trans-continental railway has some kind of trans-Pacific steamer connections as its western terminus, and the incompleted lines in both Canada and Mexico have contracts for new Pacific steamer lines to follow the common track to Asia.

Prospective Port Changes.—This great multiplication of railways and Pacific steamship lines is cutting into the early predominance of San Francisco in this trade. This port had the

first trans-Pacific steamship line and the first trans-continental railway; and, naturally, in that period she had no rivals. The present leadership of Puget Sound as the American gateway for the traffic of the north Pacific route does not mean that the San Francisco is actually declining or is likely to actually decline in the amount of trade. It means that other trade is arising elsewhere and that San Francisco will have a smaller territory to serve, but, within the smaller territory, a steadily increasing traffic.

Upon the Asiatic side Yokohama, Shanghai, and Hongkong promise to remain the great ports, while Manila at the terminus will have a steadily increasing trade. The northern ports of Tientsin, Newchwang, and Vladivostok which are now supplied chiefly by coasting lines from the greater ports, must eventually, with the development of Asiatic railways, have traffic sufficient to merit direct communications, as have the newer ports upon the American side and upon the north Atlantic trade route.



CANADA
UNITED STATES
ATLANTIC
PACIFIC
San Francisco
Chicago
New York
St. Louis
Norfolk
El Paso
Galveston
Mobile
New Orleans
Key West
Bermuda
Bahama Is
Gulf of Mexico
MEXICO
Tampico
Mexico
Campeche
CUBA
Jamaica
Kingston
HAITI
DOMINICAN REP.
Port au Prince
Sto. Domingo
Caribbean Sea
Guadeloupe
Dominica
St. Lucia
Barbados
Trinidad
NICARAGUA
Bluefields
Tegucigalpa
Panama
Medellin
Caracas
VENEZUELA
Bogota
COLOMBIA
Cali
GUIANA
N.Y. to C. 1874
N.Y. to S.J. 1860
N.Y. to B. 1860
New York to Liverpool 1867


TRANSPORTATION MAP
OF THE
LATIN-AMERICAN
COUNTRIES
Railroads in operation
Railroads under construction
Navigable parts of rivers
Steamship Lines
Distances given, are in Nautical Miles
Data copied from relief map in
Pan-American Union, Washington, D.C.
OCEAN
OCEAN
BRAZIL
BOLIVIA
PARAGUAY
URUGUAY
Porto Velho
Villa Church
Cerro de Pasco
Callao
Lima
Pisco
Cuzco
Arequipa
Mollendo
La Paz
Oruro
Arica
Potosi
Uyuni
Iquique
Antofagasta
Jujuy
Caldera
Tucuman
La Serena
S.Juan
Mendoza
Valparaiso
Santiago
Concepcion
Valdivia
Pto.Montt
Ancud
Cuyabá
Corumba
Asuncion
Catalao
Caravellas
Victoria
S.Paulo
Santos
Rio de Janeiro
Paranagua
Desterro
Pto.Alegre
Rio Grande do Sul
Monte Video
Buenos Aires
Bahia Blanca
Pto.Madryn
Rivadavia
Falkland Is.
Tierra del Fuego
C.Horn
Pernambuco
Parahyba
S.Salvador (Bahia)
Aracaju

CHAPTER IX

SOUTH AMERICAN TRADE AND TRADE ROUTES

Geographic Barriers to Commerce and Routes.—The geographical conditions of this continent have opposed the development of commerce and commercial routes, and South America to-day rivals Africa in the extent of its commercially unpenetrated land mass. Like Africa, it forms a solid block of land with a somewhat regular coast line and a consequent dearth of good harbors, making poor facilities for the commerce of the sea to connect with the commerce of the land. When the land is attained, the trader finds access to the interior is difficult because a mountain wall surrounds the greater part of the continent. The Andes extend without intermission along the entire western coast. Upon the east the highlands of Venezuela and Brazil, although not so high as the Andes, bear much the same relation to a large part of the Atlantic side of the continent.

Further than this, it is difficult to reach the plateau because of the inhospitable nature of the coastal plain lying between the base of the plateau and the sea. From Guayaquil, 3° south of the equator on the Pacific side, around the northern and eastern parts of the continent to southern Brazil, the shore plain is almost uniformly forest clad, low, hot, and marshy, infested with insects, and subject to malaria, yellow fever, and all tropic diseases that thrive in that climate. This is a constant barrier to the growth of prosperous maritime cities and a hindrance to the conduct of commerce with the interior.

As a result, the ports are usually small cities, limited strictly to the purely commercial operations necessary to the handling of imports and exports. Another and usually much larger city is commonly nearby on the more healthful plateau. It is in reality another part of the same economic community. The city is merely divided and only that part remains on the natural shore site which absolutely cannot go up to the more wholesome hills.

La Guayra is the port for Caracas, ten miles away in the mountains. Santos is the great Brazilian coffee port, but Sao Paulo forty miles inland on the plateau is the real center of the region. Rio Janeiro is an exception to the rule in that it is a large city, but Petropolis on the heights twenty-five miles inland is the place of residence for the leading citizens of Rio Janeiro, including the official representatives of foreign governments. The situation in Santos is graphically described by a local saying that the inhabitants are vitally interested in, and talk about three things—the price of coffee, the rate of exchange for the fluctuating Brazilian currency, and the yellow fever which has for generations been rife upon the low and unwholesome coast. It is easy to see that the climate of the coast has been a great drawback to the settlement of the continent by the Europeans. If the eastern coast of North America had presented so unfavorable a front to the colonists the progress of settlement and trade would have been delayed many decades, perhaps a century, possibly more; for the reputation of the land might have been made by its coast, and such a repute would not have invited the colonists.

The coast of South America has still further drawbacks for commerce. The Pacific shore plain from northern Peru 6° south latitude to 30° south is essentially rainless and desert, except where irrigated by streams flowing across from the Andes. The only South American coasts offering ready access to colonists lie between 30° and 40° south latitude and include the agricultural region of Chile and the southern states of Brazil, Uruguay and central Argentina. With the exception of the coffee plateaus near the tropic in Brazil, these are the only parts of the continent in which extensive colonization has occurred and where the European races outnumber the colored races. In many of the tropic American countries there is but a small percentage of white people, the great bulk of the people being the aborigines or, as in central and northern Brazil, negroes and mixed races.

The Apparent Advantage of Rivers.—The interior of South America, although cut off by the plateau, consists of a vast plain to which three great, navigable rivers give entrance, and apparent solution of transport problems. The Orinoco, the

Amazon and La Plata drain valleys whose extent and fertility are only equalled in the temperate zone by the Mississippi, the Yangtse-kiang and the Danube. But owing to the floods, forest, malaria, and other disadvantages of the torrid zone, civilized communities have only been able to avail themselves of one-fourth of one valley, that lying along the southern or temperate part of the La Plata system. No large tropic valley in South America has yet been settled in any modern sense. They have been explored more or less, some of them have settlements here and there, but practically all the land is in a state of nature.[1]

A Continent of Short Trade Routes.—As a consequence of the natural conditions outlined above the settled regions of South America are on or near the coasts, and with small exceptions the commercial life of the continent passes along a number of short routes that connect the centers of population with the common highway, the ocean. With the single exception of the rubber gatherer's boat on the upper Amazon, there is no spectacular South American counterpart for the long caravan routes that traverse the deserts of Africa or the plains of Asia; no counterpart for the long-drawn Trans-Siberian Railway; no transcontinental railway lines like those of North America; no daring schemes like the Cape-to-Cairo Railway of Africa. In mere weight of difficulty, however, the Andes Mountains are the greatest single barrier that modern commerce has assailed. Lacking long routes, South American commerce gravitates by many short feeders to the ocean, the one great highway of commerce, which sweeps around the continent from Panama to St. Roque with a stream that is increased by the contribution of a multitude of parts, both great and small. Owing to the unorganized internal transportation conditions and the lack of routes for assembling and distributing, the continent requires for its commerce many more ports than does North America, Europe, or Asia. There is a regular service between Europe and ten ports on the Atlantic and Gulf coasts of the United

[1] Astonishing proof of this emptiness is furnished by the recent journey of Mr. Sauder of England. To the horror of all Brazilians he plunged into the wilds of Goyaz and followed his compass to Manaos, about 1000 miles. Instead of the terrible and gigantic savage in which all Brazil believed, he found no human being and no traces of them. He reports that in comparison to it African exploration is easy, and Thibet is child's play.

States. On the coast of Chile alone there are twelve ports to which the European steamers advertise a service. Other coasts are equally rich in places at which ships stop, although

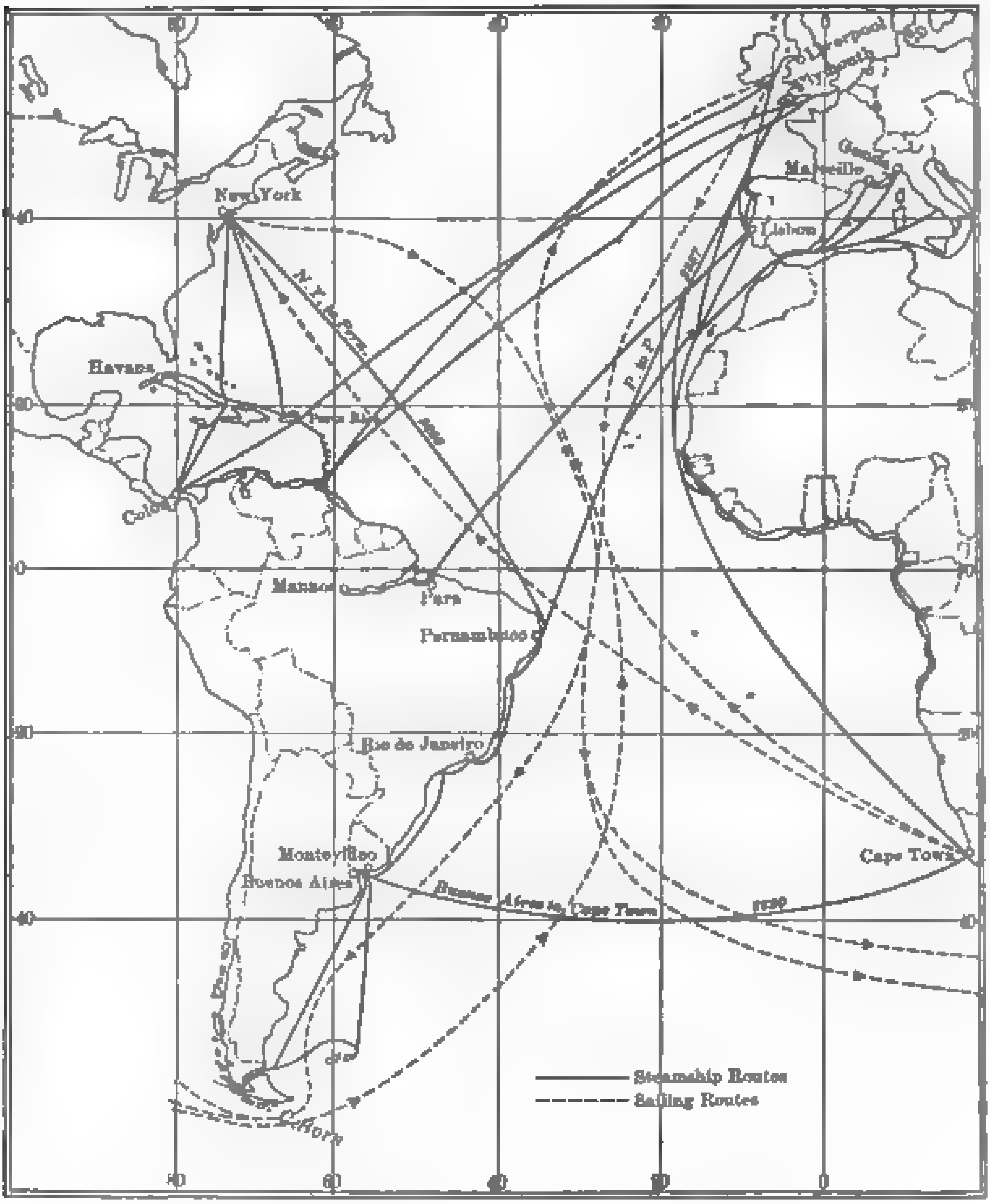


FIG. 235.—The vessel tracks of the Middle and South Atlantic.

many of them are far from being satisfactory harbors. For every little port there is an inland route or routes, but many of them are as insignificant as the little-known ports they serve.

Foreign Termini of South American Trade.—All South American routes alike have Europe and the United States upon their other ends, yet these regions are from 2,000 to 8,000 miles away as vessels go. At the same time there is no trade with Africa just across the south Atlantic in one place but 1,600 miles away. There is physical space for a dozen ferry-like routes if trade called for them, but regions have nothing to exchange unless there is a difference in production and wants. This the two continents lack. They lie in similar latitudes, under approximately similar climatic conditions; there is no great difference in density of population to make one of them a manufacturing region. Step by step we may measure these two neighboring continents down, and the economic basis for the exchange of products is not found to exist; therefore there are no trade routes. The whole trade in the south Atlantic is that passing between the temperate zones and the tropics and that passing between a manufacturing region and a region producing raw material. "Down to the sea and away to the north" might well be its motto.

The Great Route of Colombia.—In the North, the Magdalena River resembles in its service a trunk-line railway. The river itself is the trunk; and, in addition to its navigable branches, several short lines of railway are among its feeders. The river mouth is choked with sand but the two ports of Cartagena and Savanilla are connected by short railways with their river ports, of which Barranquilla on the Cartagena railway is the more important. The river steamboats are of the flat-bottom sternwheel type used on the Mississippi. The total length of navigation on the river is 900 miles and on the branches 215 miles. Rapids at La Dorada, 592 miles from Barranquilla, make it necessary to use a railway for fourteen miles, after which boats are again used. The lower valley is a green and almost uninhabited tropic forest. The chief centers of Colombian population, agriculture, and mining are on the interior plateaus drained by the Magdalena, from which the short lines of railway and numerous pack trails make connection with the river steamers. At some rainy seasons these pack trails become impassable, even for mules, which get hopelessly stuck in the mud; and at best everything that is carried to many interior towns must, if it weighs over 100 pounds, go in sections on the backs of mules.

Consequently the imports of Colombia, comprising as they do the whole list of goods required by a modern community from hoes to pianos, trolley cars, engines, and mining machinery, call for most skillful construction and packing in parts. This extraordinary amount of care is one of the great reasons advanced for the great increase of German trade over the British and American. The Germans want commerce and are willing to cater to it. The English have had it so long that they do not feel the necessity of making such effort. The Americans are in the main so profitably employed with the domestic trade that it is only an exceptional firm that cares to make the effort.

The river Atrato, draining a deep valley to the west of the Magdalena, is navigated almost to its source; but the commerce of this marshy valley is served by one or two small steamers setting out from Cartagena.

Colombia pays for her small import with coffee from the plateaus, gold from the mountains west of the Magdalena, rubber and gums from the lowlands, bananas from the northern coast, where an American owned steamship line calls for them at Santa Marta, and hides from all inhabited parts of the country. Colombian industry and hence her trade are in a depressed condition due to the ravages of destructive wars waged by rival chieftains in their attempts to gain control of the custom-house, the chief objective of revolution in many Spanish-American countries.

The Routes of Venezuela, the Northeast Coast, and the Lesser Antilles.—The center of Venezuelan population is on the cool plateau around Caracas, where there are some highways and several short railways united into a system reaching the seacoast at the ports of La Guayra and Porto Cabello. The territory served by these ports is of comparatively small area, and is limited to the highlands east of Lake Maracaibo, and north of the Orinoco Valley; but commercially this district outweighs the rest of the country just as southern Canada outweighs the rest of the Dominion.

Venezuela with its plateau population is strikingly like Colombia in its commerce except that its centers of population are nearer the sea and do not have to depend upon a long river to reach a port. The asphalt of Lake Maracaibo district replaces

the gold of Colombia as a natural asset easily accessible for export.

The longest trade route of Venezuela is that furnished by the navigable Orinoco. Steamers can ascend for a thousand miles and sometimes small ocean-going vessels go as far as Bolivar, but European and American goods are usually transferred to local vessels at port of Spain, Trinidad. Not long ago the entire river service consisted of one steamboat, and the great plain of the Orinoco with its millions of acres of grass and forest is practically unused.

The heaviest commerce in all this region is furnished by the asphalt from the island of Trinidad, adjacent to Venezuela but under British control. No product could be more conveniently placed for export than the asphalt of Trinidad Lake, the present chief source of the world's supply. As it is taken out of this natural retort it wells up from the bottom in a few hours and the place is again filled. This unending supply is located so near the sea that an overhead cableway less than a mile in length carries this gift of nature from its original location to the hold of the ocean steamer. A line of vessels does nothing but carry this product to New York. Tramp vessels by the score carry it to other American ports, to Europe, and to almost all parts of the world. With the exception of this one great product, the other exports of this district are in comparatively small quantities. From Trinidad alone the cacao bean, a highly valuable product, outranks the asphalt in value, although from the standpoint of ocean transportation it is almost negligible.

The Guianas, like Venezuela and Colombia, belong to the commercial circuit of the Caribbean. This body of water, called by the Germans the American Mediterranean, is practically surrounded by continental shores or strings of islands, and lends itself naturally to skirting voyages. The fine English mail steamers from Southampton enter the circuit at Barbadoes, a great port of call where branch lines connect with the lesser Antilles to the north and with British Guiana on the south. This branch line handles most of the mail and package business of British Guiana, leaving the sugar for tramp steamers. From Barbadoes the Royal Mail steamers go to Trinidad, the ports of Venezuela, Colombia, Colon, Jamaica and thence with pas-

sengers, mail, and bananas to New York where they receive cargo brought across by the fast trans-Atlantic liners and retrace their way to Southampton by the same West Indian and South American ports visited on the out trip. The Dutch subsidized mail line makes a similar circuit between Amsterdam and New York via the Guianas, Venezuela, and the lesser Antilles. Other lines make the Caribbean circuit from France, Canada, and New York, so that the transportation facilities are good.

The Trade and Routes of North Brazil.—From the Orinoco to Bahia, 13° south, there is a succession of ports, each the outlet for small coast settlements. Along the whole length of this coast, approximately 2,000 miles, there is but one route to the interior, the Amazon. This river and its branches afford a magnificent system of inland waterways running through a region almost entirely covered with forest and at certain seasons it is even covered for many miles with flood waters from which only the tree tops and a few islands of dry land emerge. This valley, which might rival or double China in population if it were utilized, has a forest so exuberant that man can only get and use a few of its by-products, sarsaparilla, nuts, rubber, and the sickly population probably numbers less than one to the square mile. The principal industry is rubber gathering, although some Brazil nuts and cocoa are exported. The recent increase in the use and price of rubber has brought prosperity to the Amazon valley; its three ports, Para at the mouth, Manaos 860 miles up stream, and Iquitos 1,100 miles beyond in eastern Peru, having a busy trade. For the number of people involved the trade of the Amazon is heavy and, upon its import side, varied. The people of the tropic settlements produce little but their exports; and import from the Portugese farmers in the mother country surprising quantities of fruits, vegetables, and other products of agriculture. Steamers from England, calling en route at Portugal, regularly go as far up as Manaos, 15-foot boats to Iquitos and some of the branches are also served by steamers.

There are many streams in the Amazon system that could be made navigable by the use of American "snag boats" such as are constantly employed in pulling logs and other obstructions out of the Mississippi River. Some authorities place the possible

navigation of the Amazon Valley at 15,000 miles, but the part at present navigated is far below that. The Amazon receives now the commerce of a considerable region in eastern Bolivia, since the completion of the only important improvement on the whole system, the building of 200 miles of railway, now completed, to connect the navigable lower Madeira with its Bolivian branches above the 18 cataracts. It is estimated that there are 3,000 miles of navigable rivers in the Bolivian plain, a region that has been greatly isolated because of the separation from the Pacific by the Andean wall and from the Atlantic by the Madeira Falls, around which occasional small quantities of import goods have been taken up the river by native porters and boatmen. An attempt some thirty years ago to build this railroad was made by an American party, which met gloomy failure and was driven out much reduced by famine and the almost pestilential fevers that overcame them in the tropic forests around the cataracts. The present enterprise at railroad building there has been prosecuted under somewhat more favorable conditions, resulting from greater knowledge of sanitation gained at Panama.

Between the Amazon and Riò Janeiro, Brazil, is an exporter of sugar, cotton, tobacco, and hides. After the Amazon, the next in length among Brazilian inland trade routes is that from Bahia to the upper course of the San Francisco River. Bahia is the center of an important coast district and the terminus of a railway 300 miles long connecting with the steamers on the San Francisco above the falls that break its lower course as it descends from the plateau. This inland waterway is navigable for about 700 miles, but the population and commerce of the upper valley are slight, the greater part of the commerce of Bahia having its origin in the coast districts. Pernambuco is another important port of a coast section much like that about Bahia.

The Railway Net of the Coffee States.—The greater part of Brazil's foreign trade originates in the Amazon and in the two ports of Rio Janeiro and Santos, the chief ports of Brazil and the ocean termini of the trade routes over which passes Brazil's leading export, coffee. Brazil's rubber district and her coffee district are farther apart and more thoroughly separated physically and commercially than the Washington wheat country

and Alaska. The Brazilian coffee district occupies a broad plateau and has a railway system which has developed into the only railway network in tropic America, with outlets at the two ports, Rio and Santos. These roads also carry the Brazilian manganese ore; and the traffic on the Santos line has recently made it necessary to double track the road from the port to the inland metropolis, Sao Paulo, which is a city European in population as well as in appearance, being largely inhabited by thousands of newly arrived Italian immigrants. The extremities of this Brazilian railway net reach by devious routes points as far as Cleveland and Columbus, Ohio, are from Philadelphia and Baltimore. As this plateau produces more than half of the world's supply of coffee, and as the United States is the greatest coffee-consuming country, the commercial relation between that country and Rio and Santos is heavy, though one-sided. We import Brazilian coffee by the tens of shiploads, but export to Brazil by the shipload, so that the balance of our trade is very much against us. On the other hand, we export to Europe much more than we import, while Europe manufactures the kinds of clothing and luxuries required in Brazil, so that the result is a curious triangular trade whereby Brazilian coffee goes to the United States and the United States pays for the coffee with cargoes of agricultural produce and manufactures sent over the North Atlantic trade route. Europe, in turn, pays for the American cargoes by sending shiploads of manufactures to the Brazilian coffee growers. This peculiar traffic movement has long been recognized, steamship lines have been organized to follow the lead of economic conditions, the vessels making triangular voyages between Rio Janeiro and Santos, New York, Liverpool, or Manchester. Rivaling coffee in bulk is the coal import of about a million tons, chiefly from England.

The River Plate Valley.—Various European lines call at the small ports of agricultural South Brazil, Paranagua, Porto Alegre and Rio Grande du Sul; but the River Plate or La Plata Valley is the next trade route of importance on the east coast. Here one of the great rivers of the world, under the names La Plata, Parana and Paraguay offers an open route far into the interior. Ocean steamers ascend in large numbers to Rosario, 230 miles above Buenos Ayres. Commodious river steamers

ply regularly from Buenos Ayres to the ports of Paraguay.[1] From Asuncion, small steamers wind through the swampy forests to Cuyaba, 680 miles to the northward in the heart of the tropics. By this circuitous route the Brazilian governors go out to their posts at Cuyaba, the capital of the remote and sparsely peopled state of Matto Grasso, which is larger than Great Britain and France. This wild, little known, semi-arid highland has until recently had only a few settlements and no industry except a few diamond mines and cattle ranches. The commerce of the upper Paraguay is correspondingly light.[2] From Paraguay to the ports of Argentina and Uruguay there is a lively traffic in maté, hides, oranges, vegetables, and other sub-tropical produce sent to the colder lands down stream. The one railway of Paraguay running southeast from Asuncion is being extended to connect with a northeastern line from Buenos Ayres.

The Argentine Routes.—The fertile plain of Argentina to the west of the lower Parana and La Plata is low, healthful, of easy access to the sea, rich in sheep and cattle, wheat and maize, and possesses the best railway net in South America. The foci of these lines are the ports of Buenos Ayres and Rosario. Their advantages can only be appreciated when we speculate upon the advantages that would result if Duluth and Chicago were seaports. Rosario has such a good harbor that grain sacks slide by gravity down chutes from the warehouse on the bank to the steamer in the river. Westward from longitude 64° west, the rainfall is insufficient for agriculture and the network of railways gives way to four single lines going directly across the

[1] The dependence of Paraguay upon this river is thus depicted by an American Consul Report, April 18, 1911. "Paraguay is shut in on the west, north, and east by hundreds of miles of thick, almost uninhabited forest country. On the south the greater part of the outlet is barred by swampy land, practically without population. From the day of its discovery to the present time the country has had only one artery of exit and entrance, the Parana River. Both the Parana and the Paraguay are difficult rivers to navigate. They are shallow and full of sand bars and other obstructions, and in time of drought become so low that even ships built especially for the service are frequently delayed for days. To this inaccessibility may be largely attributed Paraguay's backwardness; not directly, but indirectly, for its isolation has made immigration of progressive people and adoption of progressive ideas very slow."

[2] Recently an industrial railroad has been built eastward from the upper Paraguay. Most of the work is being done by Jamaica negroes and the enterprise is European; the financial magnate, an American. Jamaica negroes also built the railroad around the falls of the Madeira river.

plains to the irrigated districts at the foot of the Andes. Two of these roads lead to the northwestern province of Tucuman, the sugar producer, 900 miles from the Atlantic ports. A third railway is the Trans-Andean line, finished in April, 1910. It shortens by many days the winter journey between Buenos Ayres and Santiago, which had previously required a steamer journey through the Straits of Magellan because the mountains could not be crossed. It will also make possible a Pacific outlet to the important fruit and wine industries of Mendoza and San Juan, sub-tropical Argentine provinces at the foot of the Andes, much nearer the Pacific than the Atlantic.

The wheat-growing and stock-raising industries are extending to the south and southwest, and including the lands of Patagonia. Railway extension is following those changes, and the new southern port of shipment, Bahia Blanca, is rising in importance like a new Galveston. Already it is the center of several lines from the wheat district to the north and there is prospect of the early completion of the line across the plains to the lake district in the southwest. The more abundant rainfall in the vicinity of the Andes south of 40° south produces some forests and excellent pasture, promising good traffic for new railways.

The Parana Valley and the Argentina plains are agricultural in the American sense. They are exporters of grain and animal products. They began commerce as a pastoral region, exporting such valuable produce as hair, wool, hides, tallow, and bones. Thirty years ago experiments proved that Argentina could grow wheat; less than twenty years ago she began to export the heavy surplus and is now an important factor in the world's supply. Of late years corn and flaxseed have also entered the list to a lesser degree. Meanwhile the production of animal produce is in no wise diminished. Here, in this remote corner, where animals were so cheap as to be slaughtered for their hides, tallow and bones, the great firm of Liebig began then to make meat extract, a product requiring a minimum of transportation. Of late years refrigeration has made possible a large export of meat from this district and the cattle at times are even carried the long journey to Great Britain alive. Here is a rival of the United States having more sheep and over half as many cattle and an insignificant home market. These ports export in most cases

to our market, Europe, the same things we export to it. Hundreds of steamships loaded with grain and meat annually make this voyage. The return cargo of manufactured goods fills but a portion of the ships; others take coal, which is by all means the bulkiest import of the region, Great Britain alone sending a million tons to Argentina; and so cheap are the out freights that even bricks are carried from Europe to the southern hemisphere.

Although commerce is predominantly with Europe there is a basis here for American trade. We are importers of wool, skins, and hides, and since Argentina has become an agricultural country, she is an importer of agricultural machinery, in the manufacture of which we lead the world, so our steamship lines to Argentina, although less numerous than those of Europe, are prospering.

The southern part of eastern South America is a part of another triangular vessel movement. Argentina exports more in bulk and value than she imports. South Africa imports much more in bulk than she exports, so the vessels that discharge at Cape Town, finding no cargo there, often swing across the south Atlantic to the mouth of the La Plata, load a return cargo for Europe, and join the great procession northward bound along the coast to Cape St. Roque where the Europe and America bound ships separate.

South of 40° south latitude, South America has no important trade routes. It is a region which but a little while ago was called Patagonia, and was left as the unchallenged and unexplored domain of wandering savages, but is now very rapidly being converted into sheep ranges. The only port of importance that has yet risen in this region is Punta Arenas on the Strait of Magellan, the base of supply and export for hundreds of miles of coast exporting the products of sheep ranches and some gold mines.

The Commercial Isolation of Pacific South America.—Pacific South America is a commercial world to itself. The Strait of Magellan alone is as long as the distance from Hull to Bremen. It is crooked, narrow, rocky, and beset with snowstorms and shipwrecks, so that vessels usually tie up at night. The commercial part of Chile is farther away from Buenos Ayres in both

time and actual distance travelled than New York is from France. As a consequence the vessels that trade between Argentina and Europe do not go to the west coast and the west coast liners do not stop at the east coast except occasionally to call at Montevideo for coal. Vessels north bound for America usually coal at Barbadoes, for Europe at St. Vincent. The most important coaling station on the west coast is Coronel on Concepcion Bay in southern Chile where there are mines right beside the sea producing about a million tons per year, much of which goes directly to ships' bunkers, while north Chile imports her coal from Australia and Britain.

The Character of the Coast District.—The western or Pacific side of the continent, because of the narrowness of its plain, and difficulty of travel in its slope, has a multitude of small and often inferior ports. In 4,000 miles there are but six railroads that cross so much as one range of the Andes; only five railroads reach the plateau, and none cross it to the east slope except the Trans-Andean line to Argentina which reaches the part of South America having the best outlet to the Atlantic. Few coasts are so devoid of back country. There is not in this whole length of the continent even a second-class navigable river and only in part of Chile and in western Ecuador is there any valley worthy of mention. The agricultural region of Chile lying between 30° and 40° south consists of a long narrow valley between the Andes and a low coast range in which frequent breaks give access to the ports of the Chilean coast. The valley resembles the valley of California and chief of the ports is Valparaiso, the beginning of a trunk line of railway which has many small feeders and traverses the agricultural region to Port Montt, a frontier port on the forested shore of the Chilean inland sea, at the extreme end of the valley, 700 miles south of Valparaiso. This road is now being actively pushed northward by the Chilean government which, with its war-like ambitions, wishes to free itself from the dependence upon the sea which is now so absolute. This trunk railroad, now 1,100 miles long, has 850 miles more under construction and the rest surveyed. It is to connect Port Montt (latitude 42°), on the southern gulf in the land of heavy rain, with Arica (latitude 18°), 2,132 miles away in the tropic desert. It will probably be a long time before commercial needs can make the

northern half of the road economically profitable. It crosses and connects a succession of little spur lines each of which serves its purpose by connecting some mines with the sea.

South American Minerals Support Governments.—In the arid coast plain of northern Chile, the port of Iquique is the terminus of a short but very important railway that connects the most important nitrate of soda refineries with the seacoast and makes Iquique the greatest nitrate port in the world, with yearly shipments of nearly a million tons. Other similar ports in the same vicinity swell the total exports of minerals to the north Atlantic to over 2 million tons per year.

The mineral wealth of this west coast seems destined to the support of dynasties. During the third quarter of the nineteenth century the Peruvian government lived and grew reckless on the income of the guano deposits of the Chincha Islands. At the present time the Chilean administration similarly subsists on the nitrate taxes. During the colonial period the Spanish monarchy had similar support. Within less than 30 years after the discovery of America the hardy Magellan had rounded the continent of South America and the Spanish conquerors shortly established an empire along the Pacific shores of South America, whose exports almost alone supported the Spanish monarchy for two centuries and a half and made it the dominant power of Europe. This trade was peculiarly one-sided. It consisted of the exchange of authority and regiments on the one side for gold and silver on the other. The Spanish conquerors found great stores of precious metal in western South America; and for many years continued the supply by compelling the natives to work the mines, whose produce was carried back to Spain in the royal galleons. In 1575 Sir Francis Drake, the English explorer and buccaneer, entering these harbors, found heaps of gold and silver and piles of wheat lying practically unguarded upon the wharves, awaiting the coming of the Spanish king's tribute ship, the only ships ever before seen in those waters.

The Steamship Lines.—The baffling winds and calms of this coast caused it to have a steamship line to Panama (1840) before there was such a line across the Atlantic. But the heavy commerce then as now (1912) depends upon the Magellan Route. In the past twenty years a number of steamship lines have been

established between Europe and the west coast of South America; and three lines run by Americans, with their headquarters in New York, go around the continent and as far north as Peru or Ecuador. All of these lines carry outward a general assortment of manufactures, machinery, clothing and the supplies for a raw material producing country. The return cargo consists predominantly of nitrate of soda from northern Chile and, to a limited extent, of sugar from Peru, copper, silver, and gold ores from various points along the coast, and tobacco, hides, and miscellaneous agricultural products. About the beginning of the century a German steamship company, the Kosmos, extended its west coast line northward to Central America, Mexico, and the United States, so that there is now a foreign steamship service from Puget Sound to Europe by way of the Strait of Magellan as well as by way of the Strait of Malacca. There is, however, but a comparatively small amount of through produce carried by this line. It is really a coasting line loading and unloading its vessels several times between British Columbia and the snowy regions of Magellan Strait.

The Kosmos line is one of many that carries from agricultural Chile to the nitrate fields the varied and heavy freight consumed by the desert population. Much of the mineral export of this coast goes to Europe and America in tramp vessels many of which come across the south Pacific with coal from Newcastle, Australia; and some even bring coal to the Chilean smelters from Wales.

The Andean Railroads.—North of the Tropic of Capricorn the conditions of the eastern side are again repeated, and the district of greatest population shifts from the coast plain, as in Chile and Argentina, to the plateau, as in Brazil and Venezuela. This Andean highland, the highest plateau outside of Asia, runs at an elevation of 8,000 to 14,000 feet through Bolivia, Peru, and Ecuador and sinks to the enclosed valleys of Colombia where the Cauca River basin east of Buenaventura has an elevation of 3,300 feet. The plateau is enclosed on the eastern and western side by the Cordillera of the Andes, which present a front that is very high, uniform, and difficult of ascent. Over this barrier the trade routes must pass. South of the equator there are numerous trails established by the Incas and followed by trains

of llamas and mules since the Spanish conquest. Within the past forty years four railroads have, by fearful effort,[1] been built to the plateau and have become the chief means of communication with the sea.

The port of Antofagasta, in northern Chile, is the ocean terminus of the longest of the plateau railways. The line is between 700 and 800 miles long, and is being extended. It crosses the desert of Atacama and climbs to the plateau of Bolivia, which it traverses in a northerly direction to La Paz and Oruro where it connects with the steamers on Lake Titicaca. This lake was attained many years ago by the Peruvian line that connects the Pacific port of Mollendo with the lake port of Puno. The lake was already navigated by steamers before the railroad reached its shore, the steamers having been carried up in sections on mule back. The steamers cross the lake to the Bolivian town of Chililaya, which along with Oruro, for years the terminus of the Antofagasta line, was the base of caravan trade to La Paz and other plateau points. Sometimes as many as a thousand pack animals could be seen at one time loading goods for the mines and settlements across the plateau. The Peruvian railroad extends northward from the lake and is intended to reach Cuzco, the ancient Inca capital, part way down the slope toward the Amazon. This railroad and the one to Antofagasta carry a limited amount of freight that is destined to, or comes from the eastern slopes of the Andes, but the chief dependence of the railways is upon the mineral and pastoral products of the highlands. Large arid plains there are covered

[1] The difficulties of Andean railroading are illustrated by the first trans-Andean line that was formally opened, April 5, 1910.

"The tunnel is 12,000 feet above sea level, between Valparaiso and Buenos Ayres.

"Heretofore winter travelers have been compelled to go round by the Strait of Magellan, which means a cold and stormy voyage of fourteen or fifteen days. The tunnel project after being twice abandoned was finally accomplished by an American syndicate organized by W. R. Grace & Co., of New York.

"On the Argentine side the railway tracks are brought up the mountains by a series of 'rack sections,' or zigzags, as far as the first tunnel, called El Navaro, which is 5,325 feet long. Then, by a steel viaduct, they cross a tremendous gorge to the second tunnel, which is 15,195 feet long.

"On the Chile side the mountains fall so rapidly that it was necessary to build a series of screw-shaped tunnels describing a corkscrew 27,840 feet long and dropping 2,762 feet in that distance. The aggregate length of the several tunnels is eleven miles." (*Philadelphia Ledger*, April 6, 1910.)

with salt and borax; the historic Potosi mountain of silver and tin has never been worked by scientific methods, yet the plateau is one of the important tin districts of the world. Copper, gold, and other minerals seem to be abundant and their exploitation has but begun. Tens of thousands of square miles of mountain pasture support the llama and alpaca, while the sheep of Bolivia and Peru (according to some estimates) rank in number with those of leading American sheep states. A new railroad from Arica in north Chile to the plateau was about finished January 1st, 1913.

Peru has another plateau railway extending from Callao past Lima to Oroya and Cerro de Pasco, an important mining district on the high plateau. A few years ago Cerro de Pasco ores were being carried on mule back a distance of ninety miles to Oroya. This railroad was built by an American in the days of Peruvian prosperity, at a cost of $200,000 per mile through the terrible Andes, which, like the Mollendo road to the southward, it crosses at an elevation greater than that of Pike's Peak or Mt. Blanc. But the mineral resources of the plateau are great enough to warrant such effort.

The Peruvian coast, like that of north Chile, has several short lines. They serve the coast settlements and sugar plantations in an arid plain where 1 1/2 million acres are irrigated with Andean snow water and another million acres may be irrigated later.

The Ecuadorean Railroad and Commerce.—The fifth Andean railway is in Ecuador. This country possesses a fertile and well-watered plain between the mountains and the Pacific. Here is the port of Guayaquil, the gateway to forests producing palm nuts and cacao; but the truly equatorial climate causes the center of Ecuadorean population to be in the enclosed plateau about 40 by 300 miles lying between the ranges of the Andes containing the world-famous volcanoes Cotopaxi and Chimborazo. Here nearly a million people lived until near the end of the first decade of this century, entirely cut off from all communication with the commercial world, except by a pack trail descending from the 10,000-foot plateau by perilous ledges and crossing swamps that often become impassable in the rainy season. A 350-mile railroad has at last been constructed from Guayaquil

to Quito, the capital. It opens no new trade routes, but will revolutionize the methods and commerce of an old one. It makes possible, for the first time, the participation of these people in world's commerce. This road practically annexes to the commercial world a new province containing a million people. Their commerce is likely to be of limited extent because they live in the temperate zone climate of the high plateau where the country is so rough that there is small likelihood of their having any surplus of wheat, corn, or beans to send any farther than to their neighbor of the tropic plain, if perchance they can compete even there with temperate zone breadstuffs. Their exports are, therefore, likely to continue largely of hides and wool, a little rubber from the eastern forests, and minerals of which the country claims considerable store. The imports comprise the whole list of manufactures and supplies needed in a modern city and in a surrounding farming district.

The Route to Western Colombia.—The northernmost Andean trade route connects the Pacific port of Buenaventura, in Colombia, with the enclosed valley along the upper course of the Cauca River. This stream is a branch of the Magdalena and therefore drains into the Caribbean, but the mountains of central Colombia cut it off from the Atlantic by a high plateau and convert the valley into impassable narrow canyons with tumultuous waterfalls. The Pacific is reached by the passage of a single range of the Andes less than 6,000 feet high, hence nearly all commerce to and from the valley passes over the trail from Buenaventura on the Pacific to Cali on the Cauca, where the traffic divides to go up and down the valley. A short railway runs from Buenaventura to the foot of the mountain; the remainder of the distance is covered by pack animals. This valley differs from all the other regions within the Andes and tributary to the Pacific in being low enough (3,000 to 3,500 feet) to be thoroughly tropical in its production and trade.

The Panama Canal and the Extension of Andean Trade Routes.—The trade routes of western South America will be materially affected by the opening of the Panama Canal. At present these routes are all feeders to the great ocean trunk line, which must pass around the entire continent to reach the markets of the north Atlantic, which are almost the sole markets for

South American products. The steamship lines running to Panama carry the mails, passengers, and a limited amount of freight, but the main current of commerce is via the Strait of Magellan. The opening of the new outlet toward the north will change the direction of the commercial current and the land routes of western South America will have their termini from 2,000 to 8,000 miles nearer the markets of the north Atlantic. This advantage will give a reduction in costs, a speedier delivery of goods that will stimulate the industries, and extend the railroads and trade routes of the Pacific side of the continent.

In the Andean region of Bolivia and Peru the opening of the canal promises to materially affect the Pacific routes by extending them down the eastern slope.

The probable extension of railways and mining will intensify the present demand for the sub-tropical and tropical food supplies produced in the fertile valleys of the eastern slope, and desired on the plateau, a fairly populous region of temperate climate. Pack trains now supply La Paz and other plateau towns with lowland produce. Industrial development will give efficient railway service from the Pacific to the plateau, and, coupled with the greater demand for agricultural products of the east slope, will be the ability to transport engineering supplies and extend the plateau railways into the lower country. Such extensions are a part of the plan of each of the three Andean roads of Bolivia and Peru and even of others that have not yet left the Pacific plain. The Antofagasta road has reached La Paz, standing at the head of the valley of the River La Paz flowing to the eastward. Abundant water supplies will furnish electric power if it is required. Many streams pass through 10,000 feet of descent in a short distance. The agricultural produce brought up to the plateau is and will continue to be paid for largely with goods imported from United States and Europe.

The communities of the eastern Andean slopes trading chiefly with the plateau will tend to use the route for the export of such commodities as they may send to foreign countries, and the trade routes from the Pacific will extend at least as far eastward as the navigable waterways of the Amazon system, where they will make possible the development of trans-continental routes, where, for thousands of miles, the continent is now utterly un-

crossable except by the hardiest of exploring parties proceeding at the risk of life.

The activities of the American financial genius, Farquhar, promise rapid developments in South American railway extension. It was he who built the Madeira railroad. He has acquired thousands of miles of railway in Uruguay, South Brazil and Bolivia and a transcontinental line from Rio Janeiro to North Chile is proposed.

CHAPTER X

THE TRADE AND ROUTES OF AFRICA AND THE GOOD HOPE ROUTE

The Newness of African Commerce.—Although Africa was circumnavigated before America was discovered, the sinister title of "Dark Continent" has stood into this very decade for the mysterious continent, devoid of commerce, but filled with the hidden dangers of the venomous unknown. African commerce has been thought of in terms of beads and savage barter, but now no continent is changing faster than Africa, since improvements in transportation have at last reached the "Dark Continent." Its present commerce is relatively small, but a much more active future is promised as a result of the new transportation routes now being opened in all directions. African railroads and steamboat lines are being pushed much faster than commerce actually warrants because colonial governments and the colonizing powers in Europe are building lines into the wilderness to subdue territory in the hope that commerce will come later.

Africa remained a closed continent until the end of the nineteenth century because the climate is usually bad for Europeans and because geographical conditions made the interior hard to reach. The regular coast line possesses very few good harbors. The continent generally is a plateau with abrupt descents toward the sea and a level interior, in some parts flooded during the rainy season. The great rivers, which in Europe, Asia, and America offer easy navigation far into the interior, in Africa come tumbling down toward tide level, blocking the navigation. These falls may make wondrous power some day, but for the past they have kept the continent closed. In the tropic sections the coasts are usually low, swampy, malarial, and unwholesome, almost prohibiting land transit to the interior and giving to the explorer and newcomer a most unfavorable idea of the entire continent. Only at the extreme ends of the continent have we had a coast

which human beings could prosper and white men live in
pproach to comfort. Fortunately there also was the Nile,
ne river which, despite its ten cataracts, has erstwhile

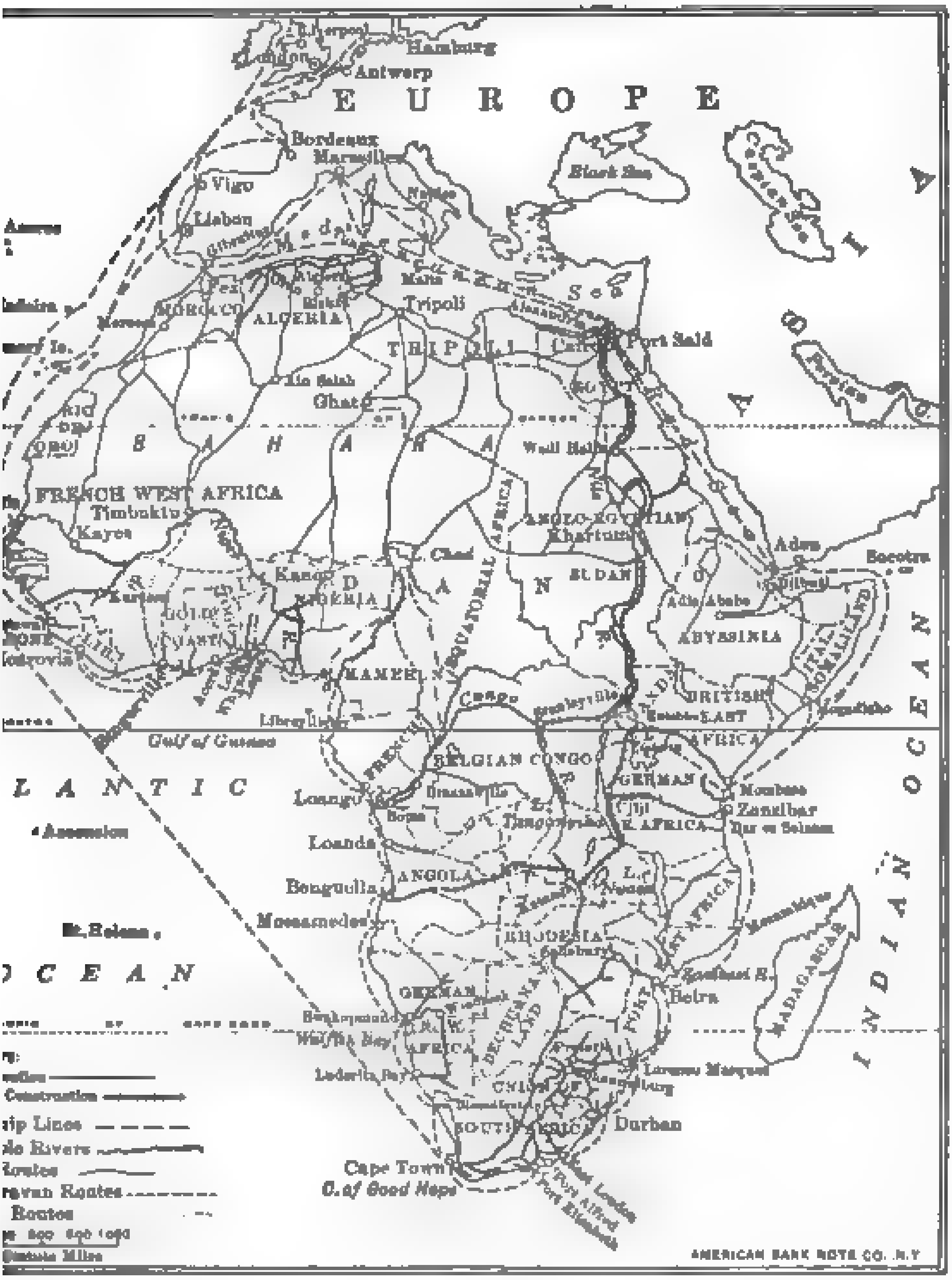
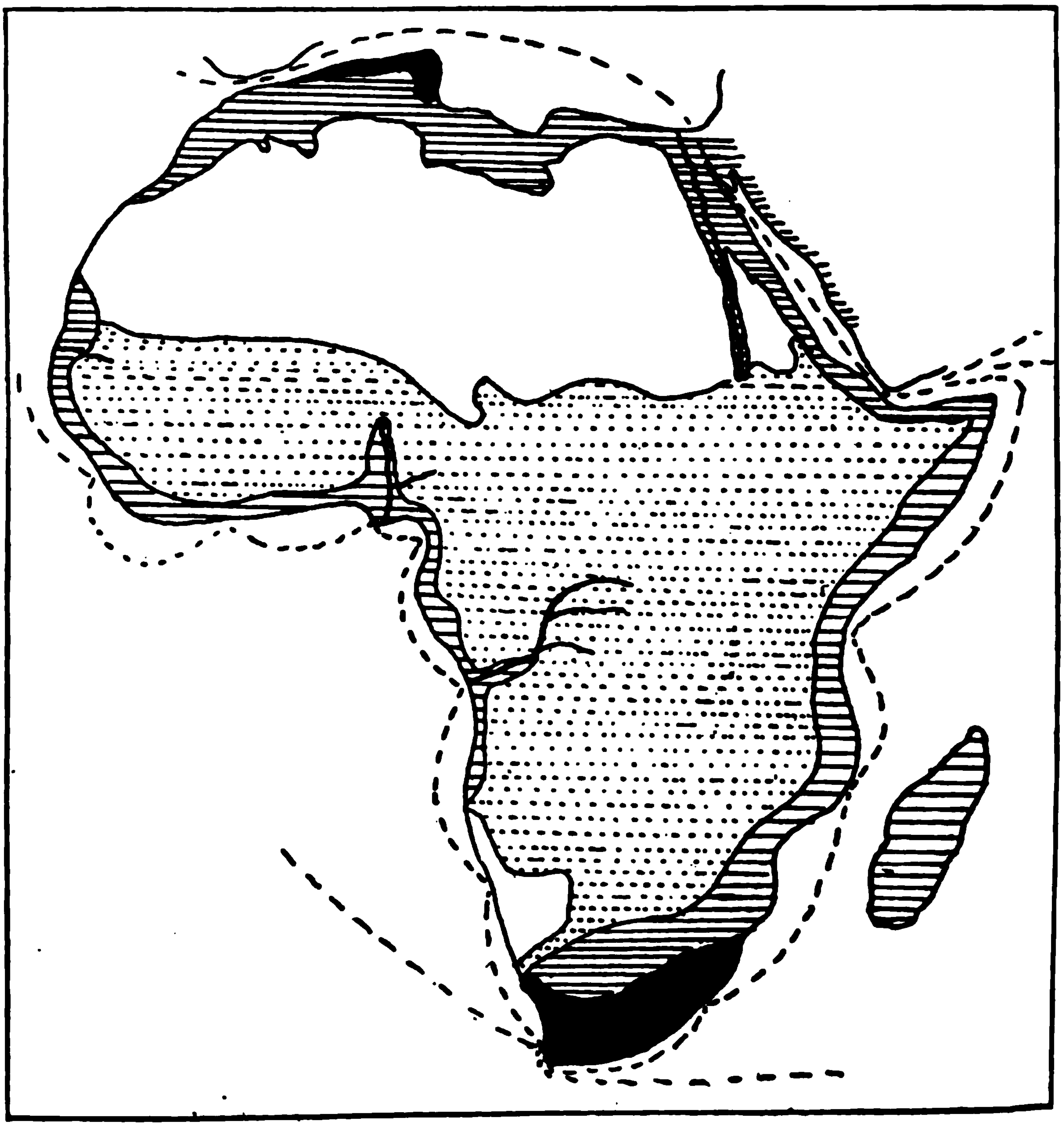


FIG. 236.—Trade routes of Africa.

of some service to navigation and has in its valley
red one of the oldest and most historic civilizations.

Commercial Zones of Africa.—The continent is further
d along east and west lines into five distinct economic

zones, within each one of which the similar economic conditions of the people have not permitted extensive exchange, and between which the natural barriers to travel and transit have been almost



Regions of large commerce.
Regions of important commerce.
Regions commercially undeveloped.
Desert or unproductive regions.

FIG. 237.—The trade zones of Africa. (After Robt. M. Brown.)

prohibitive of any kind of communication, except that carried on by the exploring expedition. The best of these five regions, the temperate extremities of Africa—Barbary States and the Cape region—have not offered a favorable base for African

development because they have a semi-arid climate and are cut off from the extensive and torrid interior by the two remaining economic (or uneconomic) regions, the Kalahari desert in the south and the vast stretches of the Sahara in the north. Despite the blistering blank of the deserts that have cut off the temperate and sub-tropic ends from the tropic middle there has been a limited trade across the wastes to the very large region comprising tropic Africa. In its eastern reaches the arid part of south Africa has more rain than Sahara, and east of the mountains the trade winds give good rainfall for there is here no moisture-blocking land mass like Arabia.

The Transportation Methods of the Old Africa.—Three distinct methods of transportation have prevailed in the different parts of Africa. Wagon trains drawn by oxen have carried trading expeditions from the cape to the Zambezi River; and the well-known caravans of the Sahara have kept up a feeble trade between Morocco and the Mediterranean ports on the one hand and Timbuctoo, Lake Tchad and other Soudan points on the other. The interesting and picturesque "ship of the desert," the camel, and the camel caravan, have been much emphasized in the education of the youth of western civilization, and it is therefore easy to overemphasize their importance in world commerce. Statistics of the Sahara caravan trade, which sets out from Algiers, Tunis, and Tripoli, indicate that it amounted at the beginning of the twentieth century to but little over half a million dollars annually.

Central Africa has the third and least efficient means of transportation. Between the Soudan and the Zambezi the meager commerce, until recently in the hands of Arabs and negroes, has been borne in canoes or by caravans of men, because the climate was fatal to beasts of burden. Some ivory, rubber, skins, palm nuts, and other products of high value were carried to the coast by these laborious means, and bartered for European goods brought by the vessels that traded along the coast.

The Partition of Africa and the Reconstruction of the Routes.—Excepting Egypt, Barbary, and the Cape, all of which are in the sub-tropical extremities, the commerce of Africa was too small, its prospects too unfavorable, to tempt the colonizing powers of Europe till late in the nineteenth century. Then

came the scramble for African possessions; as the nations began to stake off their homesteads then others rushed in before it became too late. The whole central region of [illegible] was quickly divided; and a new era in African commerce began.

The European powers have annexed, divided and traded land and reconstructed the map. Now the European pioneers, explorers, capitalists, and colonizing governments have begun the laying out of railroads and steamship lines to replace the feeble means otherwise provided.

Naturally the easiest way to begin was to send good steamers to the coast. The ocean must ever be the great thoroughfare of African trade. No other continent promises to be so absolutely dependent upon ocean commerce, for Africa has less prospect than any other continent of developing manufacturing and agriculture that will supply her own needs, and therefore will have greater dependence upon other continents whose products she can get only by trade across the sea which skirts her even coasts. The coasting steamers of England and Germany have already well attended to Africa's ocean routes.

Scores of African coast ports are now regularly visited by European steamers and the continent is regularly circumnavigated in both directions. From this base the attack upon the land has begun. From important ports railroads are being or have been built inland to tap the navigable lakes and rivers, and pierce the very heart of the continent with the steam-driven freight carriers of civilization.

Victoria Nyanza, Tanganyika and Lake Tchad are no longer names of mystery. These lakes, like the Congo and Niger rivers, have steamboats on them; and the London daily papers are only a month old when they get to Lake Albert Nyanza.

The Leading African Railways.—The most important railway systems of the continent are the Egyptian and South African. The Egyptian line now ends at Khartum in the Soudan, at which point it connects with steamers on the upper Nile which continue the service to the boundary of the Uganda Protectorate, 5° north latitude. The new transportation facilities carry the products of the Nile Valley to Alexandria, are stimulating Egyptian industry, and steadily increasing the commerce of Egypt, which has already given Alexandria the heaviest commerce

handled by any port of Africa. It is a rather surprising fact that even in Egypt highways are little used and that the donkey and camel are the chief means of carrying produce to the railroad and the steamboat.

The South African lines are making greater industrial changes than are the Egyptian railways. Egypt has always had its Nile, but South Africa has had only its veldt and its oxen. The railroads which are so necessary are going in many directions to develop a constantly enlarging frontier. Cape Colony, Natal, the Transvaal, and Orange River Colony are a pastoral and mining region, resembling some parts of the western United States and having an area a little larger than Texas and New Mexico. This region is in the early stages of ranching and agriculture, is being rapidly settled and has an expanding railway net. The backbone of this railway system, the trunk line running north from Cape Town, is being pushed steadily northward. In 1910 it was far beyond the Zambezi and more than half way from the tropic to the equator. In 1911 it had reached a point 165 miles beyond the boundary of the Belgian Congo. It has five side lines connecting with the ocean at Port Elizabeth, East London, Durban, Lourenco Marques and Beira.

These roads carry down to the sea the wool, hides, and mohair of the ranchmen on the arid plains and the gold and diamonds from some of the world's greatest mines. In exchange comes a great variety of European and American manufactures needed in the mine, farm, repair shop, and home. As is the case with most such regions the leading classes of imports are iron and steel, including machinery, clothing, and food.

Cape-to-Cairo Railway.—These two British railway systems of north Africa and South Africa are the backbone of the Cape-to-Cairo railway project, which will get its first through connection by the use of steamships on the lakes and upon the Nile for several degrees in equatorial Africa. The all-rail route was found to be practically impossible where the tremendous inundations convert large areas of the upper Nile valley into a condition which is neither land nor water, but an impassable tangle of aquatic vegetation that baffles all man's land or water vehicles. In its modified form the route can be completed easily, but with

the original plan it could be built only by selecting a new route in equatorial regions.

This impressive enterprise was the dream of Cecil Rhodes, an empire builder. It will be built, but as a carrier of through traffic its prospect is not bright. It will be 6,850 miles in length and at the end of 1911 four-fifths of it was in operation. The only road to which it can be compared is the Trans-Siberian, and Africa needs such a line far less than Asia. The Cape-to-Cairo line does not tap a land-locked, remote continental center. When completed, it will be a very long railway paralleled the whole way by the open sea from which it is easily accessible and with which it cannot compete in freight rate, if perchance it can in speed.

There can be no better indicator of its probable traffic function than an examination of the traffic on that part of the Cape-to-Cairo line which already reaches nearly 3,000 miles from Cape Town into the tropics far beyond the Zambezi. This road has already five side connections tapping it from the south and east and the completed line will probably have as many more. The chief function of the Cape-to-Cairo line will be to connect a number of shorter lines that come inland from the various eastern ports. There is surprisingly little freight passing from Cape Town to Johannesburg and Pretoria, half way along the first 2,000 miles already in operation. These cities receive most of their imports through the side railroads from Delagoa Bay and Durban, a tendency which will leave the completed Cape-to-Cairo line no more through trade than exists on the line from Bordeaux to Odessa. The side lines which will break the hope of the through traffic are being constructed in advance of the through lines, as was the case with the line from Beira. The line from Mombasa to Lake Victoria 585 miles (the Uganda Railway), piercing the very equatorial middle of the route, has been completed for several years. It connects the steamers on Lake Victoria with the Indian Ocean and also promises to be a link in a system across Africa from east to west. A railway is projected[1]

[1] There is a mighty difference between the seriousness with which we can take the projection of railways in Tropic America and Tropic Africa. Many of the American governments are poor, weak, corrupt, and properly devoid of credit. They cannot build roads or operate them; private enterprise must therefore build them for profit and then endure the disturbances of civil

from Stanley Falls on the navigated upper Congo to the African lakes, so that this district will probably be able to export its produce by the east or west route.

In the next colony to the southward, German East Africa, a subsidized railroad, is being finished in less than contract time. It connects the port of Dar-es-salam opposite Zanzibar with Tabora, a town of 40,000 people on the plateau 528 miles inland. It is expected that the men now employed as carriers in the man caravans will be of great benefit as laborers on the plantations. A railroad is also planned from Lake Nyassa to the excellent harbor of Pemba.

Large areas in this east African region, now coming into the European commercial zone, are high, with a climate dry enough and cool enough to be free from many tropic disadvantages, and Europeans are now beginning to colonize here in the hope of producing cattle and other agricultural produce in large quantities. The plateau near the Uganda railroad is 5,450 feet high at Nairobi and European ranchers have taken up a million acres of land. In the southeastern part of the Belgian Congo, a few white colonists are settling in an area estimated to have forty million acres (five times the size of Belgium) suitable for white colonization. The traffic possibilities of the central African railways may therefore be great.

West African Highways.—West Africa shows an amount of railroad building that is likely to be surprising to any one who has not followed it closely.

On the west coast the German railways run from Walvisch Bay on the Tropic of Capricorn to Windhoek, 237 miles from

wars. The African colony represents the firm hand of Europe and abundant credit. The European government backs up its colony; the colonial council dominated by Europeans uses the colonial credit revenues to build and operate a railroad at a loss or no profit in the hope of building up the colony. Thus the British East African Protectorate spends $28,000,000 to build the Uganda railway. After having been in operation several years it carried during the fiscal year 1911, 77,000 tons of freight, 400,000 passengers, spent a million dollars, took in a million and a half, leaving net earnings of half a million which should all be spent to keep the meter gauge line in order. This possible dividend of less than 2 per cent. after years of waiting is no surprise or deterrant. It is the European way of doing things. In the same year the management began a 93-mile branch line to connect the Soda Lake with the main line 282 miles inland. In Latin America a ruling dictator will grant concessions (franchises) for railway building and the concessionaries try to tempt private capitalists to build the line. Meanwhile the railroad is "projected."

the coast and to Tsumet, 359 miles from the coast. The German Colonial activity has resulted in the construction in a few years of 1,000 miles of railroad in this southwest African Colony where the rainfall is so slight that the chief dependence of commerce will be upon copper and other minerals. At present the trade is surprisingly slight. There is scarcely cause for the British alarm that has been expressed in some quarters for fear that the Windhoek road of 24-inch gauge, may cross 700 miles of desert and supply European goods to the cities of the Boer colonies at the expense of her own shorter and more efficient railways. It would, however, save some 2,000 miles of sea travel.

In Portuguese Angola, in 10° south latitude, the Benguella railway with terminus at the Lobito Bay, is being pushed rapidly eastward, 200 miles being open in 1910. The plan is to connect it with the Cape-to-Cairo line 1,200 miles to the eastward, but the immediate object is to tap the famous Katanga Copper district. From Loando and Massamedes in the same colony railroads are being pushed eastward. These roads are in a colony said to be rich in malachite, copper, iron, petroleum and salt. At present rubber and coffee are the chief exports and textiles the chief import.

The Congo River Route.—The Congo River is at present the longest and the greatest central African highway. Eleven steamers ply between the seaport of Banana at the mouth, and Matadi, less than 100 miles inland, where a 250-mile railway connects with the steamers at Leopoldville, on Stanley Pool above the numerous falls. The commercial changes of the new Africa can be easily inferred from the effects of the railroad from Matadi to Leopoldville. The journey used to require 20 days, with great loss of life. The freight rate was 2 £ per load of 65 to 75 pounds, about $250 per ton. The journey now takes two days and the freight rate is $3 per ton. From Leopoldville eastward the Congo is navigated for 1,200 miles to Stanley Falls on the equator. Here another railroad, to be completed in 1910, connects with several hundred miles of navigable waterway on the upper river, giving steam service 2,250 miles from the sea. Several branches are also navigable. Still further extensions are promised, in railways now building from Nyangwe, on the navigable upper Congo, to Lake Tanganyika.

100 miles, with its steamboats; from Stanleyville below the falls to Lake Albert Nyanza, and from Stanleyville to the rich copper deposits in the Katanga region of the Upper Congo. In 1911 there were thirty-seven steamers on the Congo above Leopoldville and a contract had been let to lay a 250-mile pipe line along the railroad to enable the river steamers to use crude oil instead of wood.

The commerce of the Belgian Congo, over $30,000,000, 1910, practically that of the Congo River, is large for Africa, and shows rapid increase. The total imports and exports were twenty-five times as large in 1900 as in 1887, and doubled in the next 10 years. The chief exports are rubber, ivory, palm nuts, palm oil; the chief imports cotton cloth and metal wares.

The Trade and Routes of the Gulf of Guinea Region.—Railroad building and the opening of trade routes are going on quite as rapidly in the jungle-clad region of the equatorial forests and the Gulf of Guinea, the late haunt of the slave, as in the less humid and more wholesome southern region. The natural riches are great; the population is large; and the whole district, except the small territory of Liberia,[1] is in the hands of energetic colonizing nations with strong governments and abundant capital.

In German Cameroon 320 miles of railway are planned; but, in the large British territory of Nigeria which joins it, much more extensive commercial equipments are in progress. Akassa, the chief port, has several hundred miles of navigable lower Niger adjacent to it, with twenty-two government steamers and many barges upon it; and, from the head of navigation, the government has completed a 400-mile railroad (3 1/2-foot gauge) to Kano, a caravan trade center and commercial metropolis in the latitude of Lake Tchad in the Soudan, 900 miles (4 days) from the sea. This is one of the least known but apparently the most populous and promising parts of tropic Africa. The latest geographers report cities of 60,000 to 100,000 people, who are, for Africa, industrious; and the climate and the country are suited to live

[1] Liberia was established under American auspices in the administration of President Monroe as a free state, a refuge for freed slaves. It has been almost swallowed up by the encroachments of Britain and France and was recently saved from what threatened to be final absorption by the intervention of the United States.

stock. It is a transition region between the desert to the north and the jungle to the south, and is said to be good for cotton growing. It is Africa's land of promise, with a cotton area in Nigeria alone of five-sixths as large as that of the United States, and the British government is not neglecting it. Two railroads have already been built to the Niger, which is being bridged (1911).

One city on the road from Logos to the Niger, Ibadan, has 200,000 population. West of this is the French Colony of Dahomey with the port of Kotonu, which had, in 1908, 192 miles of railroad, going northward into the interior, 125 miles under construction and the whole line to be 400 miles long. West of Dahomey is German Togoland where the port of Lome had in the above mentioned year 100 miles of railroad in operation and 108 under construction. West of Togoland is Ashanti or the British Gold Coast Colony. Its port of Sekondi, terminus of a 168-mile railway line, is regarded as the scene of important future trade for which jetties, piers and storehouses are already built. Between Ashanti and Liberia is the French Colony of the Ivory Coast, which, extending from the port of Petit Bassam (now Port Bouet), had 124 miles of railway and more under construction (1909). West of Liberia is British Sierra Leone with the port of Freetown whence a 30-inch gauge railway runs 227 miles into the interior to gather up their exports of rubber, kola nuts, ginger, peanuts, and palm nuts. The rapidly-growing trade of all this Guinea region is primarily the export of rubber, palm oil, palm kernels, mahogany, cocoa, and a few forest products in return for textiles, metals, liquors, salt, etc.

The West African Route to Timbuktu.—Aias for the myths of geography, Timbuktu, with its jingling rhymes, typical of remoteness, has become a commercial reality of steam and rail and telegraph; and its safe steam route to the sea has sadly cut into the traffic of the tedious caravans that had for ages wended their way from one oasis full of robbers to another on the long journey to the Mediterranean coast. To reach the region of Timbuktu, another far-reaching trade route is being established in Senegal, French West Africa. The chief port is Dakar with six lines of European steamers calling. From Dakar a railroad 164 miles in length connects with Saint Louis at the mouth of the Senegal River, a stream which has been much improved for navi-

gation so that steamers now ascend in the rainy season to Kayes, 570 miles. Kayes in turn is the western end of a 344-mile railroad to the navigable upper Niger, on which steamers run to a point 150 miles below Timbuktu, where the river becomes choked with flying sand from Sahara.

The Algerian Railway system has already crossed the Atlas Mountains; but, if continued across the Sahara, it will be for political and military, and not for commercial purposes; and it is not likely to play an important part in the economic future of the western Soudan. French publicists are, however, strenuously urging the construction of a line to Lake Tchad and the central Soudan. A more promising and certainly a more natural route to the Lake Tchad region is that afforded by the lower Niger and its navigable branch, the Benue, coming from the direction of Lake Tchad. There will soon be even a second rail route to the upper Niger, for the French are building a second road, 365 miles in length, from the port of Konakry, capital of French Guinea, to the Niger at Kourassa and 49 miles farther to Kankan. The road was about half done in 1908.

The trade of Senegal differs from that of the other colonies to the east of it in that peanuts comprise the bulk of the export.

The Barbary States.—The trade routes of north Africa are very simple. In French Algeria and Tunis the railroads serve the ports of Oran, Algiers and Tunis, where many steamers call and whence direct lines go to Marseilles, which is one of the great markets for the agricultural products of the semi-arid Barbary States with their wheat, wine, olives, wool, and early vegetables. Magador, Tangier, and Rabat in Morocco and Tripoli in Tripoli are the centers of caravan trade in regions yet without order.

Minor Lines of Transport.—Africa has of course many minor trade routes and some railroads that do not merit consideration among the leading routes. For example, there is a very long list of little stopping places on the west coast of Africa where the European steamers get the mahogany, rubber, palm nuts, and ivory which the natives assemble by any and all means in their power.

At several points on the east and west coasts are short lines of railway reaching inland from coast ports. Some of them may

become routes of importance. Probably the most promising is that from Djibouti, opposite Aden, which is intended to reach the Abyssinian plateau, and develop a large railway trade in place of the present caravan traffic. The highlands of Abyssinia possess a more wholesome climate than most parts of Africa, and a vigorous people. If peace and settled political conditions prevail, the Abyssinian railway may become one of the most prosperous in tropical Africa; at present it has the drawback, unusual in Africa, of having no government to build or subsidize it.

In conclusion the two main facts should be kept in view—that the main problem for African trade is in every case the establishment of rail outlets to the sea; and, second, that the interior has important isolated waterways which it has been the first problem of the railroad builders to tap and develop.

The almost feverish activity at railroad building in tropic Africa and European dependencies in Malaysia in comparison to the lethargy that prevails in similar independent American regions is interesting evidence in support of Mr. Kidd's[1] thesis that the enterprises and governments of the Tropics must be dominated from the temperate zone.

The African trade, like that of South America, is served in different sections by different sets of steamship lines. This is very properly so, not only because of distance, but because of the different commercial requirements of equatorial savages in breech cloth and imperial British in broadcloth at Cape Town.

South African Connections.—The first trade region in point of age and present importance is that of British South Africa. served by several lines of splendid steamers working in unison and giving service from Liverpool, New York, London, Southampton, and the Continent. The liners engaged in the South African trade pay no heed whatever to all the rest of Africa, but steam directly from Europe and America to Cape Town and usually skirt the coast to Lorenco Marques, stopping at Port Elizabeth, East London, and Durban.

Tropic West Africa.—The trade of tropic west Africa is served by a number of lines of steamers that skirt the coast from the Sahara to the Kalihari deserts. The number of ports visited is indefinite. some of the lines going all the way to Walvisch Bay

[1] Benjamin Kidd, *Control of the Tropics.*

and others attending to the needs of various smaller sections of the coast. These steamship lines make of Liverpool, London, Hamburg, Antwerp, Havre, and Marseilles the great depots of west African trade; and, from and through these ports, America and the rest of the world do most of their trading with the African coasts. Liverpool specializes in mahogany logs and divides the rubber with London and Hamburg, Antwerp gets the ivory, and Marseilles is the leader in palm oil and peanuts.

East Africa.—The trade of the east African coast is served by several lines of European steamers—English, French, and German—that come through the Mediterranean. One is a line of subsidized German steamers which come down the east coast, from Aden past German east African colonies and home by the Cape and the German Southwest African colonies. These German steamers pass over this route alternately in opposite directions. A line of smaller steamers connects with dozens of steamers a month at Aden, and runs up and down the coast to Zanzibar, an important trading center and the capital of an island producing nearly $2,000,000 worth of cloves per year. A steamship line runs from Zanzibar to Bombay and practically all of the commerce of the coast is carried on by a few thousand East Indians. Like west Africa, the chief imports of east Africa are textiles, metals, foods, and liquors, and the exports are hides, rubber, spices, and coprah.

2. THE GOOD HOPE ROUTE

Separated from, yet attached to, the trade of Africa is the Good Hope route. This is the oldest of the great ocean trade routes. It is practically co-eval with the history of America, and the commercial history of this contested route is told in the colonies and peoples that are now to be found in South Africa. The Portuguese discovered and for a time monopolized the route, and their decayed colonies still exist to the north and west of the Dutch states. When the Dutch had triumphed over Portugal they rejoiced in the monopoly of the commerce of the Far East. In the seventeenth century this trade was carried on almost exclusively by the way of the Cape of Good Hope, where the Dutch made settlements that served as a half-way post and

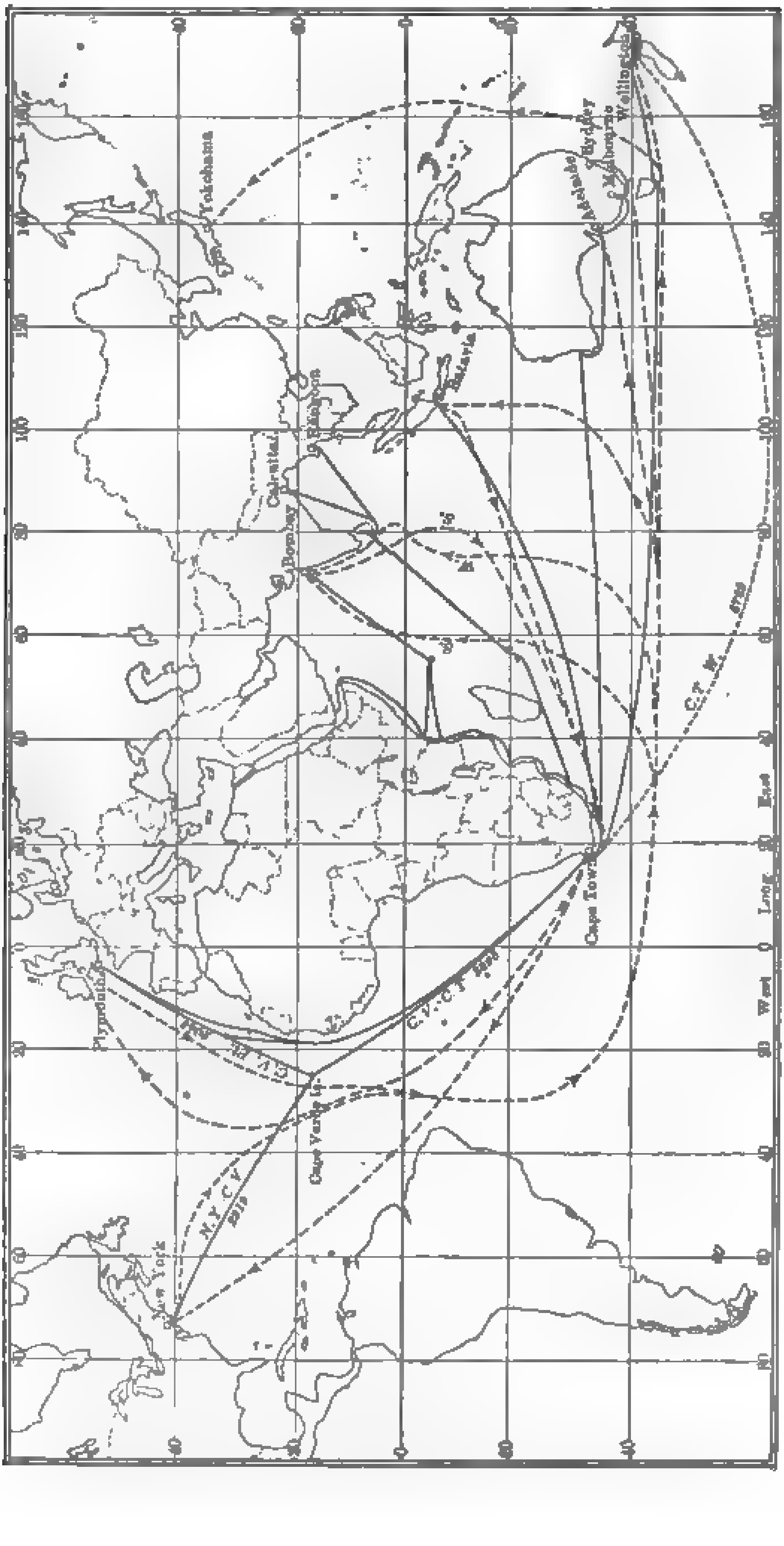


FIG. 238.—The Good Hope Route.

ictualing station for the ships bound on the long and tedious oyage to the Indies. Then followed a century of commercial nd naval struggle between Holland, France, and England, with he triumph of England. Her ships became the predominant nes rounding the Cape. She won and yet controls the colonies vhich had their start as the Portugese and Dutch half-way posts n the route to India, and her people drove the Dutch back oward the Portuguese.

The Good Hope route is really a group of routes rather than a ingle route and actually narrows to a single track at no place in ts prodigious length. The nearest approach is just below the oint of Africa, where for a short distance the steam and sail racks are brought near each other. It is at least threefold eyond that point; and, like the Mediterranean-Asiatic, it has louble termini from the eastern and western shores of the north Atlantic—the English Channel and the New York Bay. Beyond he point of Africa one branch turns to the north and follows the east coast of Africa, another goes to the East Indies, and a third directly to the south shore of Australia.

The steamer tracks in the Atlantic go so nearly north and south that there is little great circle curvature noticeable; but the great circle route from the Cape to Wellington, New Zealand, cuts off 750 miles from the distance between the same ports via Melbourne. Unfortunately, the great circle reaches a latitude of so much ice and bad weather that it is not much used as a route.

Sailing Vessel Tracks.—The Good Hope route passes over a part of the world containing great expanses of ocean and comparative barrenness of land, giving sea voyages of great length between the isolated land areas. In this respect it differs radically from the Mediterranean-Asiatic route. The great distances from the Cape of Good Hope to Europe or America, or to any other lands, have combined with the favorable winds of the Atlantic and Indian Oceans to make this route the last great stronghold of the sailing vessel. Indeed, until quite recently it has been declared that this was a stronghold from which steam could never displace sail.

This prediction has, however, been disproved by the great mprovement of the steamer and its adoption within the past ifteen years for a part of the trade of every important division of

the globe, including the various subdivisions of the Good Hope route.

The peculiar location and windings of the sailing tracks are explained in terms of the prevailing winds. For the sailing captain the quickest way is the shortest, regardless of actual distance; for the steamer captain the shortest way is usually the quickest. Or, putting it in another way, the steam navigator being practically independent of wind and current, thinks in miles and goes from point to point and headland to headland in nearly straight lines. The sailing captain thinks in days. If the vessel makes 30 miles a day by the direct route and 100 miles a day by the circuitous route where the winds are good, he makes a great detour and saves time. The peculiarities of wind and current often make detours advisable. In fact, it is almost invariably true that the steam route and the sail route between two points differ in location, and if they do happen to agree one way they are apt to differ on the return, for it is uncommon for the sailing vessel to go and return over the same track. All of these sailing peculiarities are admirably illustrated on the Good Hope route with its double sets of crooked sailing tracks. To understand them one must know the main facts of the wind systems.

In the Atlantic north of 25° or 30° north latitude, depending on the season, the wind, except when disturbed by cyclonic storms, is normally from the west at all seasons, and from the southern edge of these westerlies, down to the vicinity of the equator, the trade winds blow uniformly from the northeast. South of the equator the trade winds are duplicated, but blowing this time from the southeast. Near the latitude of Good Hope the prevailing westerlies are again reached. They blow here with great force ("roaring forties") and sweep unimpeded around the world.

The trade winds blowing from Spain toward Brazil make it necessary for a vessel from New York to go nearly across the Atlantic with the westerly wind before turning into the trades in company with the European contingent, which has had a very direct sail. The southeast trades can be crossed at best advantage by taking a right-angle course, close to the coast of Brazil, and proceeding southward into the prevailing westerlies before

which the vessel rides as far as possible before turning northward to her destination. A glance at the map shows that the combined result of the northern and southern westerly winds is to give the track from New York to Good Hope the shape of a rough letter S reversed.

Vessels rounding Good Hope from the east hug the coast as closely as possible to avoid the west winds, and if bound for New York they have a direct course going with one trade wind and at right angles to the other.

The Indian Ocean has a different wind system, with a peculiarity in it. In the winter it is like that of the Atlantic, minus a northern zone of westerly winds. In the summer the northern (northeast) trade wind is reversed, and blows toward Asia as a strong southwest wind called the monsoon. These winds make it necessary for the winter vessel from Good Hope to Bombay to creep around by Ceylon to get in a position to cross the northeast trade wind at a right angle by going up the coast of Hindustan. When the summer monsoon begins, the out-going vessel from Bombay must take the same track as the in-coming vessel in winter, for in no other way can she utilize the southwest monsoon which sets squarely toward the coast.

Coal Supply.—The coal supply upon this route is unsatisfactory, both in the supply along the route and the conditions for transporting it thither. In this respect it is probably the worst of the great Ocean routes—another factor helping to explain the late survival of the sailing vessel preeminence there. The vessels starting from Great Britain or the United States do not approach another coal-producing country until Australia is reached, full half way round the world from the starting-point. Cape Verde Islands possess coaling stations that are sometimes used; but the dearth of any adequate return freight from this region, as is the case at Cape of Good Hope, makes high-priced coal at the few ports along the route. Consequently, the vessels going to Africa or Australia aim to make little use of intermediate coaling stations, although in their total Cape Town and Cape Verde are stations of importance, being passed each year by many ships.

Traffic.—The maps clearly show that this is a long route for any of the Asiatic traffic. The opening of the Suez Canal, with

its short-cut connection, was a great blow to the traffic of the Good Hope route, which, before that time, had almost had a four-century monopoly of the trade between Asia and the West. The growth of the Suez traffic cut into the Good Hope traffic, but the great expansion of commerce during the past forty years has caused a rejuvenation of the commerce which passed to and around the Cape. Australia and Africa have risen from the ranks of outposts of civilization to states producing and consuming freight by the millions of tons. By 1910 an occasional vessel desiring to go east was too deep to pass through the Suez Canal, which the proprietors were thus compelled to deepen.

The traffic of South Africa is a very peculiar one in the world's trade. It is a region of sparse population and comparatively recent settlement. Such countries are usually producers of large quantities of raw material and consumers of manufactures, which comprise a much smaller tonnage. Such has been the commercial history of practically every country in the New World; but, owing to the scanty rainfall, which precludes extensive agriculture in South Africa, and the great predominance of gold and diamond mining among the industries there, South Africa imports several million tons per year of coal, lumber, grain, flour, machinery, and general manufactures, and pays for them in such valuable commodities as gold, diamonds, ostrich feathers, wool, mohair, hides, and skins. The old saying that "good goods come in small packages" here holds true, so that a vessel carrying a cargo to South Africa faces the almost inevitable prospect of going away practically empty. The Cape is therefore a scattering point for vessels in ballast seeking freight. Some go west to South America, others pass to Bombay for grain and cotton; to Rangoon for rice; to Java for sugar; or to Calcutta for jute.

The largest traffic movement that passes the Cape is the trade of Australia. Despite the existence of the Suez Canal and the splendid German and English steamer lines which reach Australia by that route, the bulk of Australian commerce follows the cheaper open-sea route around Africa, which is after all but 1,000 miles longer. Only the mail, passenger, and a limited freight traffic are taken by the lines on the shorter, but more expensive Suez route. The cargo steamers, of which there are many,

find it more profitable to follow the ancient way discovered by De Gama than the new one dug by De Lesseps.

A third traffic division passing South Africa is that in the sailing vessels, which still set out from Europe and the United States for east Asia. This traffic out-bound is very largely composed of refined petroleum, which is consumed in astonishing quantities in India, China, and Japan. These vessels commonly enter east Asian waters by way of Sunda Straits, between Sumatra and Java; and return by the same route, although there are times in winter when the dangers of the China Sea are avoided by a detour, taking the vessel around the continent of Australia before it turns north to reach Asia. A common return cargo for these ships is East Indian sugar or rice.

Upon the whole, the traffic and the consequent vessel movement upon the Good Hope route are peculiarly one-sided. Much (in tons) goes out and less returns, and at every turn the ships leave this route and go seeking cargo to return to the north Atlantic by some other route.

The traffic of the Good Hope route has limitations upon its future. There are not at the present time 10 million people in South Africa and Australia combined. Owing to the limited agricultural resources of these British colonies the population will not grow rapidly. That of Australia is almost static. Any trade to east Asia cannot be expected to pass around Africa indefinitely with the present decline in the use of the sailing vessel. The trade of the Good Hope route is therefore largely limited to such part of the Australian and African traffic as will continue to use it in preference to some other route, as Panama and Suez. This trade from the regions now containing 10 millions must naturally be vastly less than that of the Mediterranean-Asiatic route, which has upon its lines a population nearly a hundred times as numerous but with far fewer commercial wants than the inhabitants of the British colonies in the southern hemisphere. These people are, and will continue to be, among the heaviest per capita traders, while the Asiatic peoples are and will long be among the lightest.

The future of the American trade with South Africa and Australasia is particularly bright, because these British colonies are in the same stage of industrial development as parts of the

American West. We have had experience with their kind of physical problems, our agricultural machinery is adapted to their kind of land, as our mining machinery is adapted to their mines, and there is every reason to expect a continued and increasing trade in American machinery and supplies for the development of these new lands, while our mills and tanneries are increasingly dependent upon their wool and hides and skins.

The fact that South Africa has not been equipped by nature to start off as a great grain grower by extensive agriculture does not prevent her from having room for considerable areas under irrigation and possibly for grain growing without irrigation if improved varieties of grain are used. The same developments can extend Australia's production.

Freight Rates to Australia.—Freight is carried from the north Atlantic to Australia halfway around the world for half a cent a pound—emphatic illustration of the fact that water transportation is cheaper by far than land transportation.

The vagaries of freight rate, as set by man in the exercise of the commercial propensity to get all he can, are well illustrated by the following extract from the published report of the Manchester Association of Importers and Exporters of 1910. "At the present time textiles from New York, with trans-shipment at Liverpool, are carried by the White Star Line to Melbourne at 37s. 6d. ($9.12) per ton, while the rate charged for carrying textiles of British manufacture from Liverpool to Melbourne is 55s. ($13.38)—and by the same steamer from Liverpool."

The explanation is found in the fact that there was a rate war on between New York and Australia and a rate agreement was in force between England and Australia.

CHAPTER XI

HE TRADE AND ROUTES OF AUSTRALASIA AND THE SOUTH PACIFIC

A Watery Desert.—The South Pacific and Indian Oceans are a alm of waters, almost a world of waters, a saline, watery sert in which Australia and New Zealand are but little more an oases, and one of them, Australia, is largely desert. Compared to this wet desert the world's dry deserts are but insignifint scraps. The Pacific is classed as one of the oceans, but it is nost as large as all the rest of them combined. It is more than ice as large as the Atlantic and has an area estimated at 70 llion square miles—four times as large as Asia, ten times as ge as North America, more than one-third of the entire surface the globe—one and a third times the area of the entire land rface of the world. Its width along the equator between the inland of Asia near Singapore and South America is practically lf the circumference of the globe and nearly four times as wide the North Atlantic. Nor is the Indian to be classed among e minor oceans.

As Australia and New Zealand are the dominant and almost e only commercial factors in the South Pacific and Indian eans, their trade and commerce should be first described.

The Routes of Australia.—The problem of Australian routes fundamentally different from that of Africa. There is no pulous rain-drenched interior, with mighty rivers tumbling h the power of Niagara over the margins of a continental teau. About all that can be said in a commercial way of ch of Australia is that it is on the map. It is an immense d and semi-arid stretch with a good eastern margin and a fair thwestern corner. Large tracts in the central and western ts have never been crossed by any explorer, and many lorers have perished in attempted explorations. The agriure is practically all east of the Pacific watersheds except

a little in south Australia and a few irrigation settlements; and by the time the western boundary of New South Wales is reached the desert becomes practically absolute and even the hardy sheep herder must give up.

The most spectacular route in all Australia is for the transmission of ideas not goods—the desert telegraph line erected at great hardship across the center of the continent to the north shore, there to connect with the Asiatic cable system and Europe.

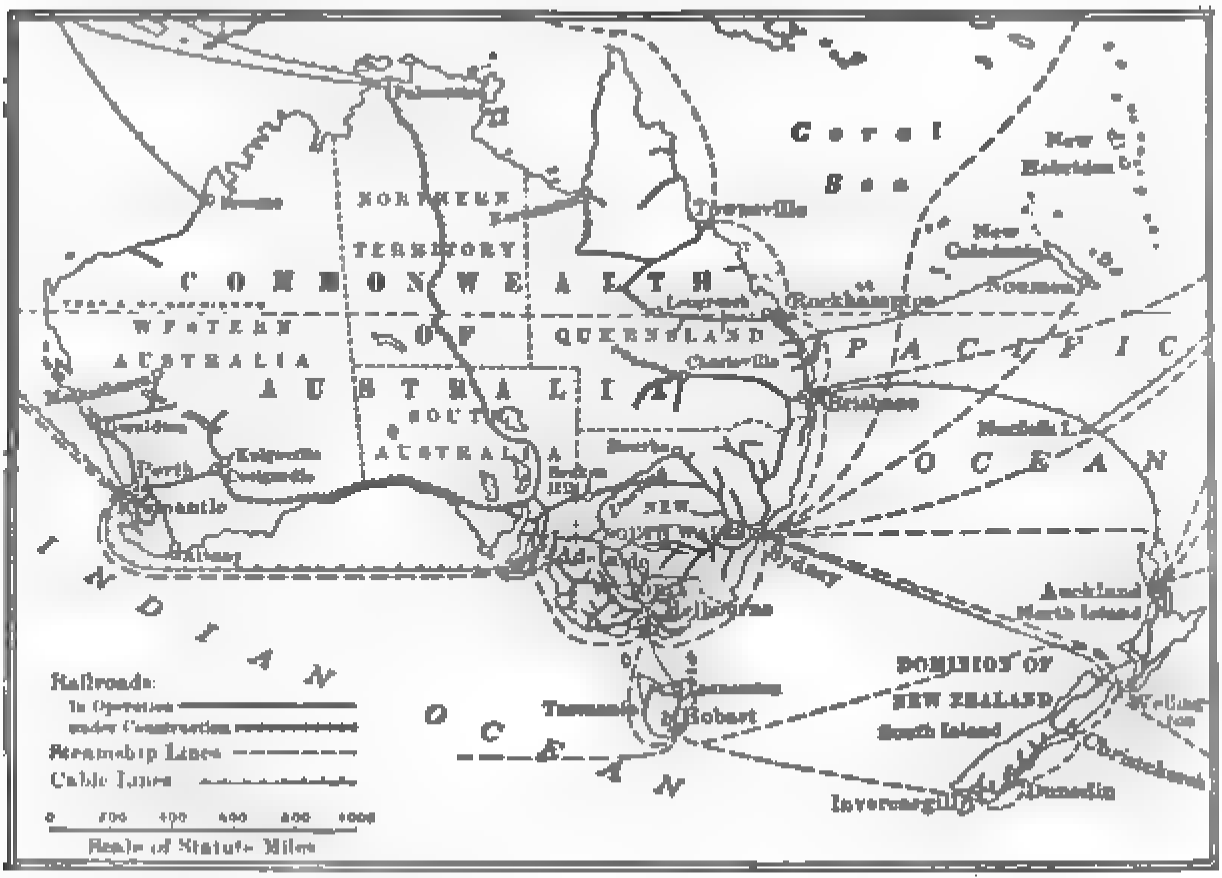


Fig. 239.—Trade route map of Australia.

The proposed[1] railroad over this route is a political not an economic expedient. The next most spectacular thing is the pipe line which carries water from the mountains back of Perth (west Australia) many scores of miles eastward into the desert to the new town around the gold diggings of Coolgardie.

[1] "The Commonwealth Government pledges itself to build a railway connecting Port Darwin on the north, the port of the Northern Territory, with the railway system of South Australia. It is estimated that this railway expenditure will amount to about $50,000,000. This Northern Territory has 523,620 square miles, or about one-sixth of the total area of Australia. Except for the small settlement at Port Darwin, it has scarcely any white population, most of it being an empty wilderness, the total population of the territory being estimated at 2,967 people, of whom two-thirds are Asiatics" (U. S. Con. Report, Jan. 5, 1911).

The inland trade routes of the continent are exceedingly simple, consisting, aside from a little fitful navigation of the Murray and Darling Rivers, of comparatively short railway lines from the few good ports to the farms of the coast lands and the pastures of the interior. These ports, in the order of their importance, Sydney, Melbourne and Adelaide, have a surprising concentration of the population of the colonies in which they are located, usually about a third of all the people being in these cities. This seems to be a condition common in newly settled regions, and a duplicate is found in our Pacific coast. The good harbor seems to get the start; the railways are built there; trade centers there; and this advantage of an early start gives no other place a chance to make a beginning. In Australia the additional political advantage of their being colonial capitals is also an important factor in letting the three ports monopolize the trade of large states. This gives great simplicity to the trade routes, which consist merely of rather thinly developed railway nets, with their foci at the port-capital. It is only in recent years that these capitals have been connected by rail.

The almost unsettled Queensland, with its long coasts, has more ports and less railroads. The chief port is Brisbane, a city of 140,000—about one-fourth the population of the colony—which does much of its trading through Sydney, with the assistance of coasting steamers which do an important trade in Australia. The whole northern and northwestern coast is virtually uninhabited, and the trade of west Australia is chiefly gathered at Freemantle, which has a railroad to the gold-fields in the desert. This road is now being connected by the Government, with the railway out of eastern Australia. It requires hundreds of miles of track through this uninhabited arid waste. It promises to be another monument to politics, not industry.

Australia's Trade Connection with the Rest of the World.—Australia is practically at the other side of the world from the United States and Great Britain, and is at the end of all routes that reach it—the European mail route that comes down from Ceylon where it leaves the Mediterranean Asiatic route, the smaller branch line that threads its way from Singapore through Toures Strait to Brisbane and Sydney, the freight lines that

pass Good Hope, and the steamer lines from the Pacific coast of the United States and Canada.

From the standpoint of traffic the Good Hope route far outweighs all others. Australia sends over this line to Great Britain frozen meat, wool, hides and skins, butter, gold and copper. In return for these staples come British machinery, cotton goods, woolen goods and a whole list of manufactured articles that are required by a highly civilized agricultural community doing but little manufacturing. Australia sends wheat, but sometimes the conditions which prevail in South Africa are repeated in Australia, and there is no export. The chief products are meat and wool—which have an average value of nearly ten cents a pound—supplemented by a large amount of gold and some copper. Consequently, the Australian imports of lumber, wood, and bulky manufactures sometimes make more tons than the export; and the vessels in Australia are in straits for out-freight. This situation is mostly found in the port of Sydney, which is due to its being the terminal port for nearly all vessels going to Australia, and the natural end of a voyage. Fortunately for the vessels seeking profitable employment, Sydney has the great advantage of being near the Australian coal-fields at Newcastle but 60 miles away. This lack of other export freight has placed Australia in a position to ship coal from the east coast as a ballast substitute. It is carried to Java, Singapore and even East Indian ports, where rice is secured. Sailing vessels take coal to Hawaii, a sugar-exporting island, or to San Francisco, where wheat is secured, or to Chile, where it is exchanged for nitrate of soda, thus permitting vessels to circumnavigate the world.

The traffic from New York over this route to Australia fills many ships a year and is largely composed of lumber and wood manufactures, iron and steel goods, agricultural and other machinery, leather goods, and a host of miscellaneous small articles. We import but little from Australia except wool; and, as we get much of that via the London auctions, the vessels that carry American produce out usually join the Sydney fleet that goes cargo hunting.

New Zealand.—New Zealand, long narrow islands with a row of good harbors, exceeds Australia in the simplicity of its inland

routes. Invercargill, Dunedin, Lyttleton, Wellington, Napier, and Auckland—all have short railways to the farms and ranches. It differs from Australia only in that the better rainfall makes better grass and hence a better supply of butter for export. Otherwise it is like Australia in its exports and imports, which are predominantly with Britain, and the place where half the property of British Australasia is still owned, the natural market for the products and the place that most Australasian families still think of as the old home.

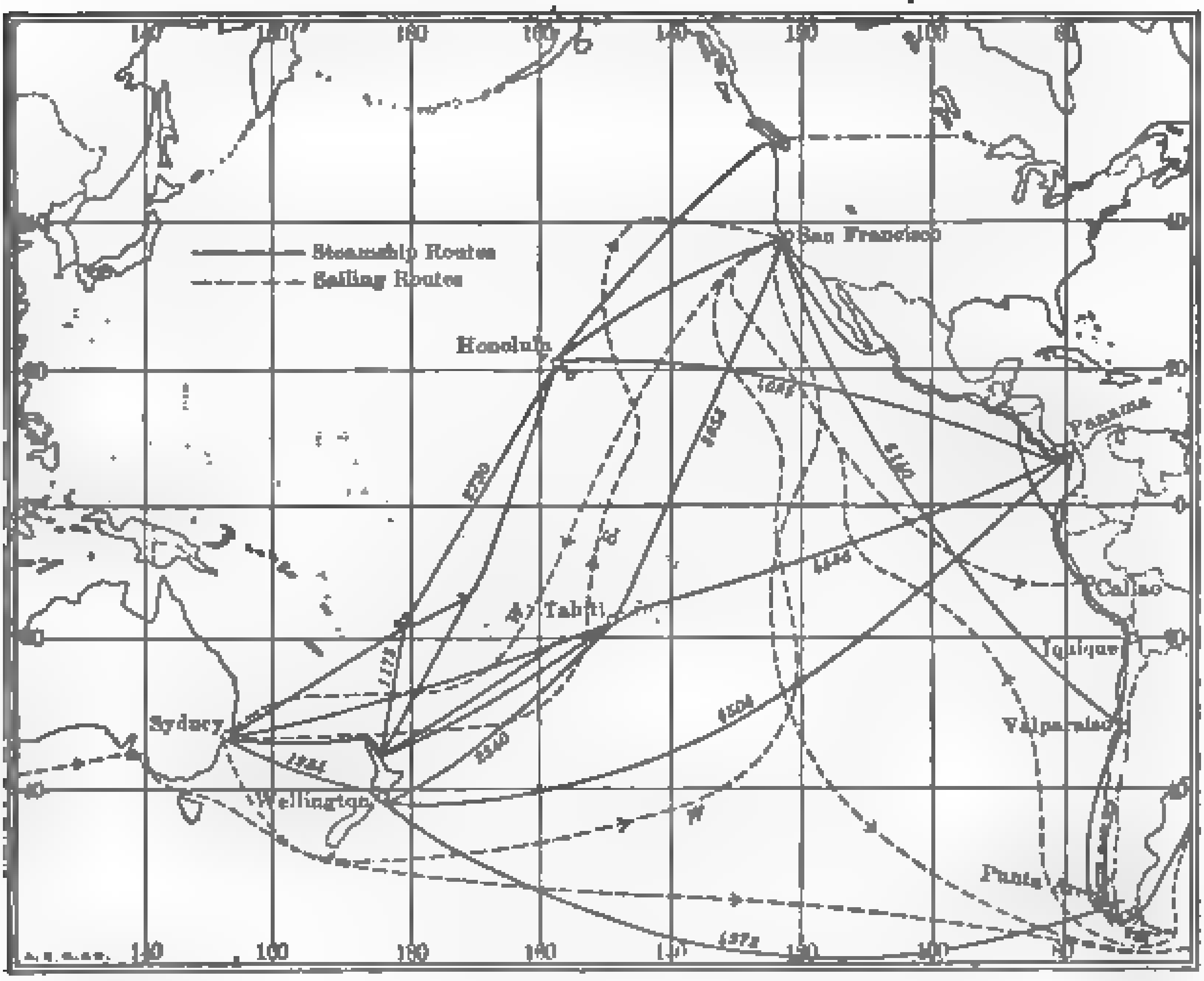


FIG. 240.—Routes of Southern and Eastern Pacific Ocean. W—winter. S—summer.

Some steamers go directly to New Zealand from New York and Great Britain, but they usually stop en route at Melbourne, and some continue the journey from Sydney to Wellington. There are good inter-colonial steamship lines between the various Australasian ports.

The Route across the Pacific.—Although Australia and New Zealand are upon the edge of the Pacific, their commerce

has surprisingly little to do with that ocean. As a result of its enormous size the rather surprising fact develops that the Pacific Ocean is practically not crossed by any important trade routes—they skirt its shores. (A globe is necessary for correct impression.) We have already seen in the account of the north Pacific trade route how that route follows the shores of the American and Asiatic continents from Panama to Singapore. The trade of South America follows down the Pacific shore to creep out of that ocean through a hole in the mountain wall—the Straits of Magellan. The Australian coal ships swing across the southern margin of the ocean to the nitrate ports and then follow the shore. Even the route from Australia to Panama, in taking advantage of the great circle, swings so far to the southward that it passes between the islands of New Zealand and follows much nearer the edge than the middle of the ocean. Some scattering vessels—chiefly sail, go with Australian coal ballast into the north Pacific, but the only trade route in all this great ocean that may really be said to cross it, is that connecting Australasia with the Pacific coast of North America.

The ports of Vancouver and San Francisco are connected with Australia and New Zealand by three rather infrequent lines of steamers. Two of these call at Hawaii and one at Tahiti, in the Society Islands. This is at present the quickest mail route from Australia to Europe because it uses the fast trains of America and the north Atlantic steamers, but the commerce is feeble both in fact and basis, since California and Australia are alike in products, race, density of population, and climate, and there is almost no cargo for the mail steamer to carry northward, and but little to go southward but lumber.

Winds and Fuel Supply.—In most parts of the ocean the Pacific is well suited for the sailing vessel. In its northern and southern parts the trade winds blow as in the Atlantic, and to the north and south of these wind areas are the same zones of the west wind. The working out of the leading south Pacific vessel tracks shows most plainly the effect of these winds. The winter route from Sydney to San Francisco, for example, goes to the south of New Zealand and nearly 2,000 miles east of it before turning northward into the trade winds. By this deviation the vessel can pass through the southern trade winds almost before the

wind and take an approximately right-angle course across the northern trade-wind zone. The summer route between these same two ports shows the effect of the same winds, but also shows that the zones have shifted somewhat to the north with the movement of the seasons. The fact that the trade winds always blow away from the coast of lower and southern California makes it necessary for all sailing-vessel tracks into San Francisco to make a wide detour to the north to avoid the trades and come in before the west wind.

The two great defects of the Pacific as an ocean for the easy development of sailing routes are the large zone of calms in the equatorial region west of South America, and the ferocious storms of the Cape Horn region. The sailing-vessel route from San Francisco to Callao in Peru is a striking example of the influence of the doldrum or calm zone, to avoid which the vessel passes nearly 2,000 miles to the west of its destination and more than 1,000 miles to the south of it to get the proper angle to sail across the trade winds and entirely avoid the zone of calms, in which the vessels idly drift for days together. There have even been cases of whaling ships which have started from the southern hemisphere to make the northern whaling season and have entirely missed it by floating for months like seaweed in the doldrum calm.

The winds around Cape Horn blow with a force rarely met elsewhere, and almost continually from the west. In addition to this, snows and storms are of exceedingly frequent occurrence, and it is by no means uncommon for vessels to spend ten, twenty, or even thirty days in almost the same spot, beating vainly against the wind which will not let them round the cape from the Atlantic into the Pacific. This accounts for the fact that the sailing vessels regularly go to Australia from the Atlantic by way of Good Hope and return by Cape Horn, and there are cases of vessels that have tried to get into the Pacific around Cape Horn, and after vain effort have given it up and gone eastward before the west wind to reach Chile or California. In the early days of steamers to Australia, the Peninsular and Oriental Steamship line (British mail) used to send its steamers home from New Zealand by the Straits of Magellan, thus regularly circumnavigating the globe, although no South American

freight was sought except that of the Chilean port of Punta Arenas in the Straits. The route was selected because of the greater ease of steaming with wind and current and has now been given up in this period of more powerful and economically operated steamers.

For steamers, the coal supply of the Pacific is better than one might expect from a consideration of the mere factors of size of the ocean and length of the routes. At each of the four corners of the Pacific is a coal-field—Japan, British Columbia, east Australia, and Chile. The central Pacific throngs with unnumbered islands, many of them having good harbors, and about five of them being coaling stations. These are New Caledonia, Fiji, Samoa, and, to the north of the equator, Guam and Hawaii. Of these islands, not one, however, is regularly used as a coaling station by an important line of steamers, the common practice being for the regular vessels to proceed from mainland to mainland without adding to their stocks of coal. But each of the four coal-producing regions at the ocean's corners possesses important coaling stations for ocean steamers—namely, Japan, British Columbia, Australia, and Chile.

The Future Traffic of the Pacific.—In the future as in the present the mid-Pacific promises to remain a realm little crossed by trade routes and bare of industry or the hope of industry. A vast stretch of ocean lying between New Guinea, Hawaii, and Japan is large enough for a continent, but absolutely uncrossed by any trade route worthy of the name. In this empty sea a new island might remain undiscovered for decades unless some whaler, or some investigating Drake or Darwin chance to sight it. With the exception of Hawaii, the only Pacific island producing large quantities of freight is the French island of New Caledonia, not far from Australia. The exports of nickel and other ores from this island furnish employment for a considerable number of vessels homeward bound for Australia. With these two exceptions, the vast Pacific is bare of islands which are capable of supporting commerce in any large modern sense. The myriads of coral islands are almost uniformly low and comparatively barren. Most of them are unpeopled, and those that are inhabited, produce little but the coconut palm. The lands upon its southwestern edge partake of the inhospitality of its

middle, for in New Guinea and adjacent islands the cannibals are still eating exploring parties and it is small wonder that about the only vessels visiting these shores are the subsidized lines which the Germans send out in their effort to build up their sickly settlements into a colonial empire. The adjacent part of Australia, Queensland, has less than one inhabitant per square mile, including cities of about 200,000 total population; and most of the shore of northern Australia is of no more use to civilized man than is the middle of Borneo, or a section of Amazonian forest, five miles from a river or a part of Canada inland from Hudson Bay—all of which are utterly unused.

CHAPTER XII

THE WORLD CARRIERS AND THE PANAMA CANAL

World commerce has a world mesh of trade routes. It also has world carriers in fleets of tramp steamships standing ready to go anywhere that ships can sail, and to pass from route to route as wagons pass from street to street. It also has world carriers in steamship companies whose services overreach any trade route and render astonishing feats in connecting a commercial community to its world environment.

While we have long since learned to think of railroads as systems, we are still prone to think of steamship lines as doing what the early railroads did—merely connecting two places. This idea must be discarded. The law of growth among steamship lines works surely to the development of trunks and branches, a development which has already taken place, although the branches are fewer than upon railroads. The improvement of the steamer and the use of the ocean cable gave the needed regularity, dependableness, and knowledge for the organization of ocean commerce and transportation into a regular and systematic service akin to that of the railroad. The great ocean lines sail with precision and regularity. To secure the supply of freight for these great lines, their managers have been compelled to establish smaller lines to supply and distribute the necessary cargo. The largest trans-Atlantic lines are, without exception, thus equipped at one or both of their termini. The North German Lloyd and the Hamburg-American connect at their European ends with lines running to South America, east Asia, and other distant parts of the world. They also connect with smaller lines plying to the near-by European ports and with steamers on the German rivers. These two German companies carry the same system even farther. Their trunk lines to east Asia are fed at Singapore and other eastern ports by lines of smaller Ger-

man steamers which traverse the eastern archipelagoes and the Asiatic coasts and rivers, collecting cargo for the trunk line stations of the large steamers bound for Bremen or Hamburg, at which ports it is distributed by the European distributors referred to above or sent on to America by the trans-Atlantic lines. The Wilson Line from New York to Hull connects in that city with an enormous fleet of small steamers which thread the coast of the North Sea and reach all ports of importance in Scandinavia and along the Baltic. Some of the other British trans-Atlantic lines connect with British coasting lines and with the lines to Australia and other British colonies. The French and Italian trans-Atlantic lines are fed by fleets of Mediterranean coasters and trans-oceanic liners at Havre, Marseilles, and Genoa. The Cunard Line, giving a service from New York to Liverpool and from New York to southern Italy and Fiume, Austria, has a line connecting Liverpool and Fiume. These steamers call at more than twenty ports and gather freight which is to be transferred at the ends of the route to the next steamer bound for America. Other examples of this systematic trunk and feeder development of ocean service might be mentioned; but they would show no feature differing from the development of the examples cited or from the railroad and its branches except that the ocean service of single companies at times circumnavigates the globe and covers a much wider scope of territory than any railroad system the world can ever serve.

The company that runs a line on one route only is at the mercy of any local fluctuation in traffic. A strike even might spoil the profits of a quarter; so might a drought or any local uncontrollable disturbance. Then, too, there are seasons in nearly all trades during which the traffic is abundant and others in which it is scarce. Just after harvest time, wheat, corn, and cotton go forward in quantity and the trade falls away to small proportions as the next harvest approaches. The steamship company with many lines can have its annual work evened up by seasonal prosperity in one quarter as dulness comes in another. Instead of having ships half idle on its one dull route, it can shift them to the prosperous route. As the vessels get old and antiquated for the finer routes they can be shifted to a slower and inferior route. The greatest advantage, however, is the picking

up of freight for the main lines, just as the branch roads feed a main trunk railroad.

All these forces are welding the ocean carriers into ever-growing systems.

The best example of this wide-reaching world carrier is furnished by the Hamburg-American Steamship Company. This one company dominates the metropolitan city of Hamburg and connects it with Montreal, Portland, Boston, New York, Philadelphia, Baltimore, Newport News, New Orleans, and Galveston in the eastern United States. It sends steamers to Mexico, Central America, Panama, Colombia, Venezuela, and several services to the Lesser and Greater Antilles. They go to the Amazon, to the ports of central and south Brazil, to Uruguay and Argentine Republic, to Chile and Peru and on up the Pacific coast of America to the ports of United States. In Europe they circumnavigate the British Isles, skirt the coast of France, Spain, Portugal, and Italy, to the head of the Adriatic; they go in the Baltic to Russia and Finland and Sweden, and out in the Atlantic to Iceland and North Cape, and on to Arctic Spitzbergen in the summer. In Africa it touches at Alexandria and down the whole west coast as far as the mouth of the Congo. In Asia it serves Aden, the ports of Arabia, Persian Gulf, Ceylon, Calcutta, Straits Settlements, China, Korea, Siberia, Japan, and finally—and possibly most remarkable of all—it sends steamers thence across the Pacific to Portland, Oregon—a grand total of sixty-eight services crossing every ocean, touching all continents and every geographic and commercial zone. Extensions are in contemplation or contracted for.[1]

Equally suggestive and almost equally far reaching is the joint organization of railroad and steamship lines. This practice, common in America, Europe, and Asia, probably reaches its highest development in the Canadian Pacific Railway which operates in connection with its trans-continental railway line a trans-Atlantic service to Europe and a trans-Pacific service to Japan, China, and Hong Kong. It also has a steamer line on the American Great Lakes.

[1] As the book goes to press the news comes of the formation of larger and yet more comprehensive groups of British lines formed by the union of the Cunard Company with other companies serving practically all important parts of the world.

THE PANAMA CANAL

Into this complex maze of world routes served by world carriers comes a new factor, the Panama Canal. This waterway will add to or take from everyone of the great ocean trunk routes. The north Atlantic, the Mediterranean Asiatic, the Good Hope, the South American, the north Pacific and the Pacific Coast (North American) Australasian. There is no continent, almost no important country even, that will not find a rearrangement in the route by which its goods go and come by sea. To their great relief, steamship lines by the score will rearrange their itineraries, and the tramp freighters by hundreds and thousands will find themselves unloosed from harassing restrictions and free to work their way around the world with a freedom that will redound to the benefit of hundreds of millions of men. The start forward to this, the greatest readjustment of all time, is not unlike the general movement that follows the signal of a policeman in a crowded street when he releases two masses of waiting men or vehicles after a parade has passed.

The possible freight for the Panama Canal lies in four main zones; Pacific North America, Pacific South America, Australasia, and East Asia. Excepting the first, all of these are marginal traffic, traffic that can seek an alternative route. The great question is—What does it cost the ship to go around? To the time charterer the cost of ships in the market enables him to tell to a nicety what they cost—and this cost varies with freight rates, and they fluctuate through hundreds of per cents.

SAVINGS BY THE PANAMA CANAL

	Nautical miles	Days at 10 knots	Days at 16 knots
Liverpool to Port Townsend..........	5,666	23.1	14.2
Liverpool to San Francisco............	5,666	23.1	14.2
Liverpool to Honolulu................	4,403	17.8	10.9
Liverpool to Valparaiso...............	1,540	5.9	3.5

SAVINGS BY THE PANAMA CANAL—*Continued*

	Nautical miles	Days at 10 knots	Days at 16 knots
Liverpool to Yokohama	−694	−2.4	−1.3
Liverpool to Shanghai	−2,776	−11.	−6.8
Liverpool to Sydney	−150	−.6	−.4
Liverpool to Adelaide	−2,336	−10.8	−6.1
Liverpool to Wellington	1,564	6.	3.5
New York to Port Townsend	7,873	32.3	20.
New York to San Francisco	7,873	32.3	20.
New York to Honolulu	6,610	27.0	16.7
New York to Valparaiso	3,747	15.1	9.2
New York to Yokohama	3,768	15.2	9.3
New York to Shanghai	1,876	7.3	4.4
New York to Hong Kong	−18		
New York to Manila	41		
New York to Sydney	3,932	15.8	9.7
New York to Adelaide	1,746	6.7	4.0
New York to Wellington	2,493	9.9	6.0
New Orleans to San Francisco	8,868	36.4	22.6
New Orleans to Yokohama	5,705	23.3	14.4
New Orleans to Valparaiso	4,742	19.2	11.8

To appreciate fully the influence of the canal on rerouting of the world's shipping is a puzzle that requires careful working

out. Will a tramp ship, returning to New York or Liverpool from a particular port, say Valparaiso or Sydney or Yokohama, use the Panama Canal? The answer to that question is decided of course by the balance sheet. We can tell pretty well how much time it will save. But what is a ship's time worth? Its value fluctuates. Plainly the use of the canal by tramp steamers will fluctuate.

In all four of the Panama trade zones the Pacific liner is getting an ever greater hold and the liner is rarely interested in getting to any *one* port. She makes a voyage and calls at many ports. The line manager is interested in getting to or from the *end port* of his chain. Thus Callao and Antofagasta and Iquique may be very important to the tramp, but the West Coast liner usually calls at each of these and at many other ports besides. The line manager in this region has two things to do; one is to call *once* at a whole string of ports, and to get his ship full of nitrate of soda so that she is sure to have a cargo. Nitrate is to the West Coast liner something to fill up on, a kind of traffic life preserver. A Liverpool liner to South America usually finds Coronel, the South Chilean coal port (as far from the equator as New York), the farthest place in which it has interest, and the same vessel may and often does serve the coast to Guayaquil on the equator. The question then resolves itself into getting to or from Guayaquil and Coronel, and Coronel is but 1,089 miles (four days at 10 knots, 2.3 days at 16 knots) farther via Magellan than via Panama. It therefore looks quite feasible for those European vessels to go down through the Canal, deliver their manufactures, finish their business at Coronel, and come home by Magellan, even though the straits will put up the insurance and may make a delay of a day.

So far as the United States is concerned, the eastward jutting continent of South America increases Coronel distances, with savings of 13.2 and 8.1 days for 10- and 16-knot speeds to New York and 17.7 and 10.7 days for similar speeds to New Orleans.

Australasia offers an interesting line situation. The line traffic is in the main a three-port service to Adelaide, Melbourne, and Sydney. From New York to Sydney the saving is nearly 4,000 miles, and when the end port, Adelaide, is reached, the

ship is still 1,746 miles nearer home via Panama than by Good Hope. And then there is the coal monopoly of Sydney to serve as a magnet to coal-using vessels.

Those facts seem to incline the New York Australasian trade to the Canal. New Orleans would have greater distance savings, but there is small comfort for any canal enthusiast in the distance figures from Britain to Australasia.

If we wish to contemplate the greatest change that the canal will make we must look at the commerce of the Orient and of the Pacific coast of America. We have here a blind alley. The canal will open out the blind end. The trade of China and Japan is peculiarly one-sided from the tonnage standpoint. This has caused one of the most astonishing voyages in the world—the continuance of European liners from Japan to the United States for part cargo and their return to Europe via Japan and China and the Suez Canal with its high tolls. The Panama Canal will be a great gain to the owners of such lines. The blind alley will open. By sending the vessels on to the eastward they will reach Liverpool in about half the time now required to go via the Arabian Sea. One of the most interesting things in all the Panama traffic re-arrangements will be this round the world movement of vessels engaged in the Oriental trade. The table of distances shows that Yokohama is surprisingly near the distance divide from Liverpool by the two canals and it is quite likely that the advantages in favor of Panama will offset that difference. The magnets of American freight and probably also of American coal, will continue to exert their influence and the ships of Europe and eastern America may go around the world one way or the other according to the demands of particular services.

It is thus plain that every one of the great Trunk Routes of the sea will be materially affected in this rearrangement of the world's ocean freight circulation.

CHAPTER XIII

THE TRADE CENTER AND ITS DEVELOPMENT

I. THE DEVELOPMENT OF COMMERCIAL CENTERS

The Origin of Towns and Cities.—An examination of the methods and causes of commerce leads to an inquiry into the causes of the growth of cities. Not only does the larger current of international trade always pass from one city to another, but the same condition is also true of domestic trade. Cities and trade are continually exerting reflex influence, the one upon the other and, to understand the large commercial movements, we must understand the economic functions and origins of the city.

The origin of the town goes back into the early history of the human race—to the days of the first permanent settlements and the first regular trade. The present-day metropolis is but a town grown large through trade, and the same laws govern its growth and push it from its village beginning to its metropolitan ending.

The beginning of commerce is a barter between two individuals. Each has a surplus of a particular article and each finds advantage in the exchange of that surplus. The most complex phases of present-day commerce are but the outgrowths of this simple exchange of goods, complicated by the numberless wants of man, the variety in natural resource, the world-wide distribution of industry and the myriad complexities of invention and manufacture.

The rise from barter to money and the expansion of trade to international proportions have produced many institutions. First and most fundamental among these is the trade center or distributing center. Granted riches and neighbors, trading man soon develops so many wants that it becomes inconvenient to visit individually the various people with whom he wishes to trade, and some common meeting place is the result. Many previously isolated individuals now have a place for common activity; some of them a place for common residence; and a

market place or fair, a village or a town comes slowly into being. It is interesting to note in this connection that in many European cities this plot of ground where the primeval trading took place continues to this day as a market square, as in Antwerp, Brussels, and many other cities now grown great. It is also to be found in many a small country town. The normal trading town is, therefore, manifestly and most naturally located in some spot easy of access, some spot with a superiority of access usually due to geographic causes. If the superiority of access is sufficiently great the settlement around this market place becomes a city with international trade, for the market village and the metropolis are alike the products of economic forces that differ only in degree, not in kind.

The Kinds of Cities.—In examining into the causes for the growth of commercial centers, one should note the distinction between industrial and commercial causes—between industrial and commercial cities. Examination shows that most cities have both commerce and industry in some degree. The mere numbers of people inevitably produce a certain minimum of trade and manufacture. As a commercial city increases in population some local industries usually spring up. And similarly the growth of a manufacturing city usually develops some commercial activity. But, in the main, the city exists because it is either a commercial or an industrial center, the one activity being only secondary or tributary to the other. In most cases it is easy to characterize the world's leading cities as belonging to one or the other of these classes. For example, Pittsburg, Pennsylvania; Birmingham, England; and Lyons, France, will be classed at once as industrial cities. New York, Liverpool, Hamburg, and Hong Kong will be classed as commercial cities. The purest examples of commercial cities are to be met with in the unhealthy seaports of the torrid zone where the conditions of life are so bad that only the most compelling of operations are there performed. Such a city is Port Limon, Costa Rica; Santos, Brazil, or Banana at the mouth of the Congo. Here are centered the strictly port or commercial activities that must be by the water's edge; while all other activities seek better locations.

In some cities the commercial and manufacturing influences

become difficult or even impossible of accurate discernment because political reasons have interfered with, or combined with the workings of geographic forces. Where several cities have approximately equal natural advantages, the selection of one of them for a national, state, or county capital will be the deciding factor that raises it far above its rivals. This force has made Paris and Berlin the great cities that they are, and the city of Washington, in a location fixed by statute and without either manufactures or commerce, exists because it is the place of residence for the thousands employed in the administration of the central Government of a rapidly growing nation.

The commercial city or distributing center, its causes and some of the influences affecting it, will be considered here. At the present time, students, publicists, and lawmakers are devoting much attention to commerce. It is necessary that there should be a clear understanding of the way in which commerce, and particularly international commerce, is carried on and why it is carried on in certain cities. Without such an understanding, legislation in favor of commerce must sometimes miss its goal and expenditures for the promotion of trade must sometimes be made without results.

The Place of Transportation in Making Commercial Cities.— Some advantage in transportation is the most fundamental and most important of the causes determining the location of a distributing center. It may almost be said to be the only cause for the formation of such centers. For some reason or reasons, a particular place is more conveniently and cheaply reached by many people than any surrounding point; and, as a result, they naturally exchange commodities there. The country store is located at the crossing of roads. There also is the village. In a mountain country the market town is at the junction of two, or, still better, of three valleys. Another favorite location is the end of a mountain pass, or a gap that is a thoroughfare between two valleys. If rivers are difficult to cross, settlements will spring up at the safest ferries or fords. In a level plain, a town will be near its center, and a focus of roads or railroads in such a plain, fertile and populous, will almost surely make a city. Any one who is familiar with the geography of a country district can see examples illustrating any or all of these forces.

The head of navigation on a river is a location far more commanding than any of those already mentioned. Here all the trade that goes by the river must be changed from one method of conveyance to another. Here goods are collected from the surrounding country for shipment by water. Here the people who bring the goods buy their supplies. Here also must be merchants, forwarding agents, and the repairers of wagons and ships. A town or even a city arises. It is interesting to note that towns of this class were relatively much more important in 1800 than in 1900. In the first-named year a river offered a much greater relative advantage for cheap transportation. But few localities could support populous settlements without water transport, for the alternative was the heavy, creaking wagon miring in the mud. The cost of carrying goods by wagon was so great that in a short distance it equaled the value of the goods and set a narrow territorial limit to commerce. So a navigable river gave its valley a cheap outlet to the sea, and the river port was a close rival in importance to the seaport. But in 1900 the railroad carried most of the freight which 100 years before depended upon the river. As a result, many places of leading importance in 1800 had in 1900 become insignificant towns. The new means of transportation, namely, the railroad, had built up prosperous cities where under the old conditions cities were impossible. Examples of this shrunken importance may be found in abundance in the basin of the Chesapeake. With its many estuaries there were numerous ports of nearly equal size in 1800, when George Washington's Alexandria was an important and prosperous place. But Baltimore has long been the seaport of the Chesapeake and Alexandria would scarce make a good ward in the rival that now serves her by rail with many sea-borne products.

The railroad train has rushed past the river port to the seaport and the giant ocean steamer has taken the trade. The most commanding location for the commercial city is the safe harbor which is, or may become, the natural outlet for a rich and populous territory. It has in greater degree and in greater extent the advantage that is to be found in the location of all the smaller distributing centers that have been cited above. It is a convenient place for the breaking of cargo. It is the extreme point

that can be reached by the most favorable means of transportation and one where operations must begin on a smaller scale and a more expensive method. Here the ocean steamer discharges its freight, which is taken forward to its destination by smaller and more expensive carrying agents—the coasting vessel, the river boat, the railroad, to some extent the wagon, and, in some countries, even the pack train. The great seaport exists because it is a place for the breaking of cargo of ocean ships, just as the country store exists because the boxes and wagon loads of miscellaneous supplies must there be divided up into numerous small packages for the individual consumer.

The Conditions for the Further Rise of Seaports.—Seaports are the focusing points of the commerce of both land and sea. Nearly all land commerce and land routes go to and fro between ports and interior points. All ocean commerce is a movement of ships and goods from port to port. What is a port; what makes a port? Any place where ships can unload in safety their goods upon the land may become a port, but among thousands of such places a few hundred actually do become ports because of their location with relation to adjacent, accessible seats of human enterprise. They rarely become ports because of any production within the port itself. The activity of the port begins primarily because it has particular advantages of access to populous regions and also particularly suitable access to the sea over which the commerce of the regions is to go.

It must be a point as far inland as possible so that the importer and exporter may have the largest advantage of the cheaper freights possible on large ships. Therefore the greater ports are at the heads of bays and gulfs rather than on peninsulas and headlands. The rugged west coast of Great Britain offers many bays and harbors for the shelter of shipping, but none of the small ports on projecting Cornwall displaces Bristol as the leading harbor of the southwest of England, for Bristol is far inland on the head of a bay. In the same way Liverpool, the great port of the west, has grown up on the indented coast of Lancashire, and not on some of the equally safe bays of the projecting coast of Wales. Similarly, Boston and New York are on bays that indent the main land, not on those more easy of entrance but near the end of Cape Cod or Long Island.

Besides easy access from the sea, the great seaport, the international trade center, must have easy access to the land and to the centers of population that it serves. This access is best supplied by a river valley with the water transportation on the river itself and canals and railroads that can be built most easily along watercourses. Nearly all important seaports are at, or near, the mouths of rivers, navigable or otherwise, and, in regions having navigable rivers, the largest cities are in locations having the best communication with the interior. New Orleans, on the lower Mississippi, has been, from its settlement, the unrivaled metropolis of the coasts of the Gulf of Mexico. Philadelphia, Boston, and Baltimore were the rivals of New York till the opening of the Erie Canal made the Hudson the outlet for the Great Lakes and of enormous territory in the center of the continent. With this advantage New York has gained a foreign trade exceeding that of all the other Atlantic ports combined. If the break in the Appalachians had been at the head of the Delaware, the Susquehanna, or the James, the location of our great commercial metropolis would surely have been different. The improvement of the railway and the cheapening of rates have caused the Erie Canal to carry a declining proportion of New York commerce, but the level country through which the canal passes is also the most favorable for the building and operation of railroads.

As in America, so in other continents, the navigable river has dominated the growth of seaports. It is not by accident that London and Liverpool are upon the Thames and the Mersey with their canal connections with the interior. Hamburg has outstripped Bremen because the Elbe is navigable even beyond the Austrian boundary, but the Weser gives Bremen only inferior communication with the "hinterland." The Nile has made Alexandria; the Ganges, Calcutta; the Yangtse-kiang, Shanghai; and Hong Kong, the island distributor for south China, lies directly at the mouth of the West River, the great highway of the southern provinces.

The Commercial City Becomes Industrial.—Being the distributing and supply point for such a region, the port has an excellent supply of raw materials, and becomes a favorable location for the establishment of manufactures. This is especially

true of those industries requiring imported raw materials. To industrial development along this line is due a large share of the growth of all the larger seaports of the world. New York is the first city in America in the value of its manufactures.

Intermediary or Entrepot Trade.—In addition to and distinct from the in-coming and out-going trade of the dependent and industrial districts, is the commerce of the second kind—the distribution of foreign goods to other foreign countries. Thus London and Liverpool have in the past had a large commerce in articles that did not originate in England and were not intended

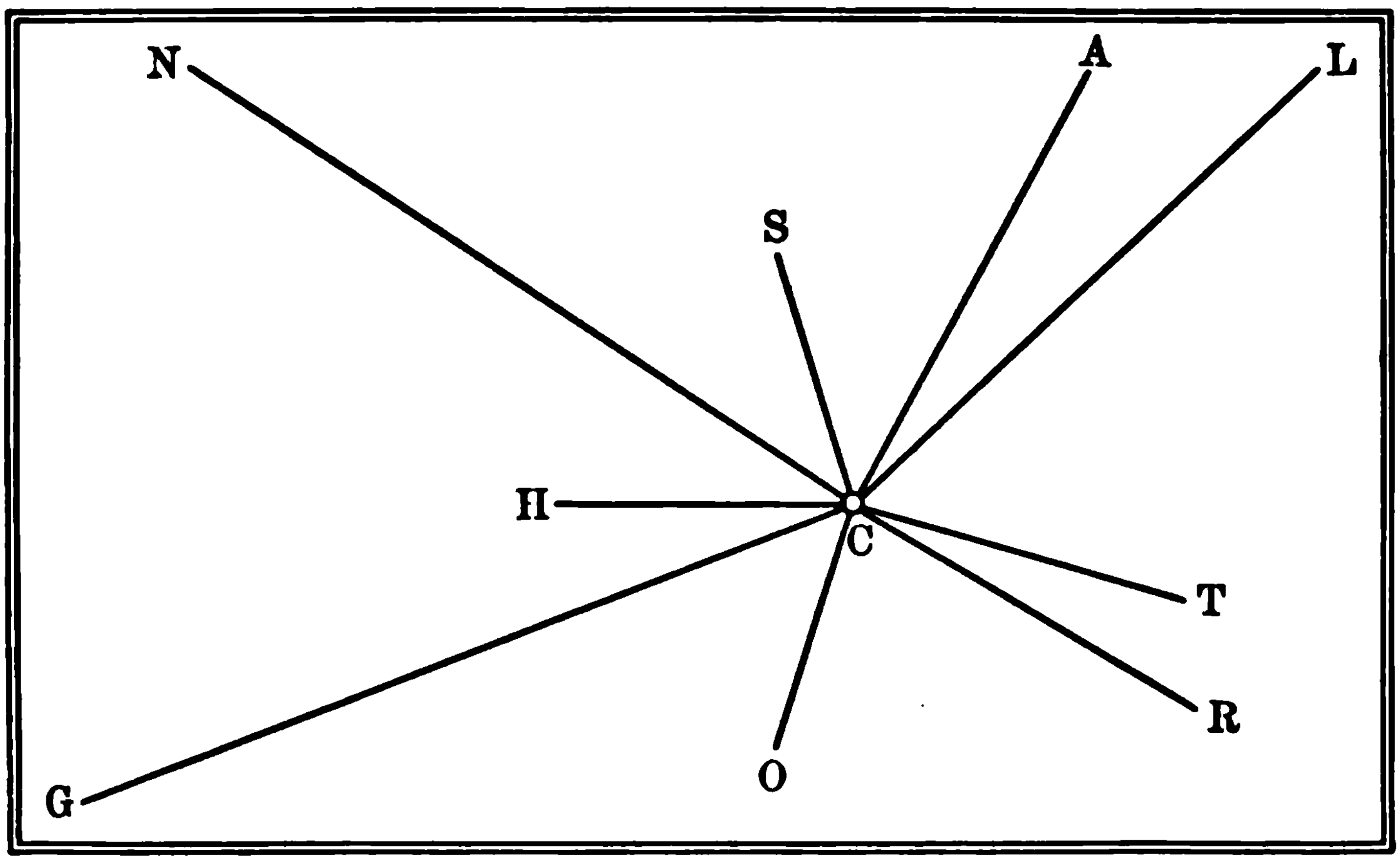


FIG. 241.—Diagram to illustrate the origin of entrepot trade. (From bulletin of American Geog. Soc.)

for consumption in England. London was the largest distributor of foreign goods. The London merchant was a middleman in international commerce; consequently, England gained in riches from this source. But the chief reason for the growth and prosperity of London was not her foreign distributing trade, but the commerce that came to her as the local center of a great industrial population and the commercial capital of the country where the most highly developed manufactures in the world fostered the largest import and export trade. The chief basis of a city's trade under modern commercial conditions is to be found in the industrial districts of which that city is the immediate distributor, and not in the business that comes to a city

as a commercial intermediary. This intermediary, or distributing trade, national or international, is the second step in the development of a city. The first step is the establishment of many lines of transportation giving connection with the various countries engaging in international trade. These are only built up and in the main supported by local demand and local production.

In the diagram C represents a commercial city that succeeded in establishing direct connections with S, H, O, R, T, and L, A, N, G, because the industrial districts around C could in part at least consume the exports and supply the imports of these outlying regions. Once these lines of transit were in operation, it was found that the consumers of G wanted small quantities of the goods produced in T, A, or R, and that the people of T, A, and H wanted the products of G. This trade was small, and the cheapest way to carry it on was through the existing connections, via the center C, which in time became the emporium whence the products of G and N were supplied to all the other countries, and whence G and N imported the assembled products of many lands.

The Economy of the Entrepot.—This may look like a wasted method with useless travel, but the movement of goods may be in such small quantities that it would not furnish sufficient cargo to justify sending a ship from G to N. Such roundabout commerce is taking place to-day and has been taking place since commerce began. There are many places about the Gulf of Mexico and the Carribean Sea that within recent years had so little commerce and hence so little transport connection with each other that the most convenient way for a traveller or for freight to move from one to the other was to go via Europe or the United States. This has even been true between the neighboring islands of Cuba and Jamaica or Cuba and Porto Rico. Persian rugs go to Constantinople, thence to Hamburg, thence to South America, Scandinavia, and Canada.

For C one may substitute, according to the period of which he speaks, Venice, Bruges, Antwerp, Amsterdam, London, and, to a lesser degree, New York and Hamburg. It will be observed that each of these cities was the metropolis of a large industrial population and had important commercial activities of its own

before it rose to the point of controlling the commerce of other countries.

Ports for Raw Materials and for Manufactured Goods.—One of the changes in the world commerce of the past century has been the pronounced separation of ports into classes. One class is the raw-material port, and another is the manufactured-goods port. The two are steadily growing more distinct at the present time. This has resulted from the vast multiplication of the bulk of commerce—a multiplication which is in turn the result

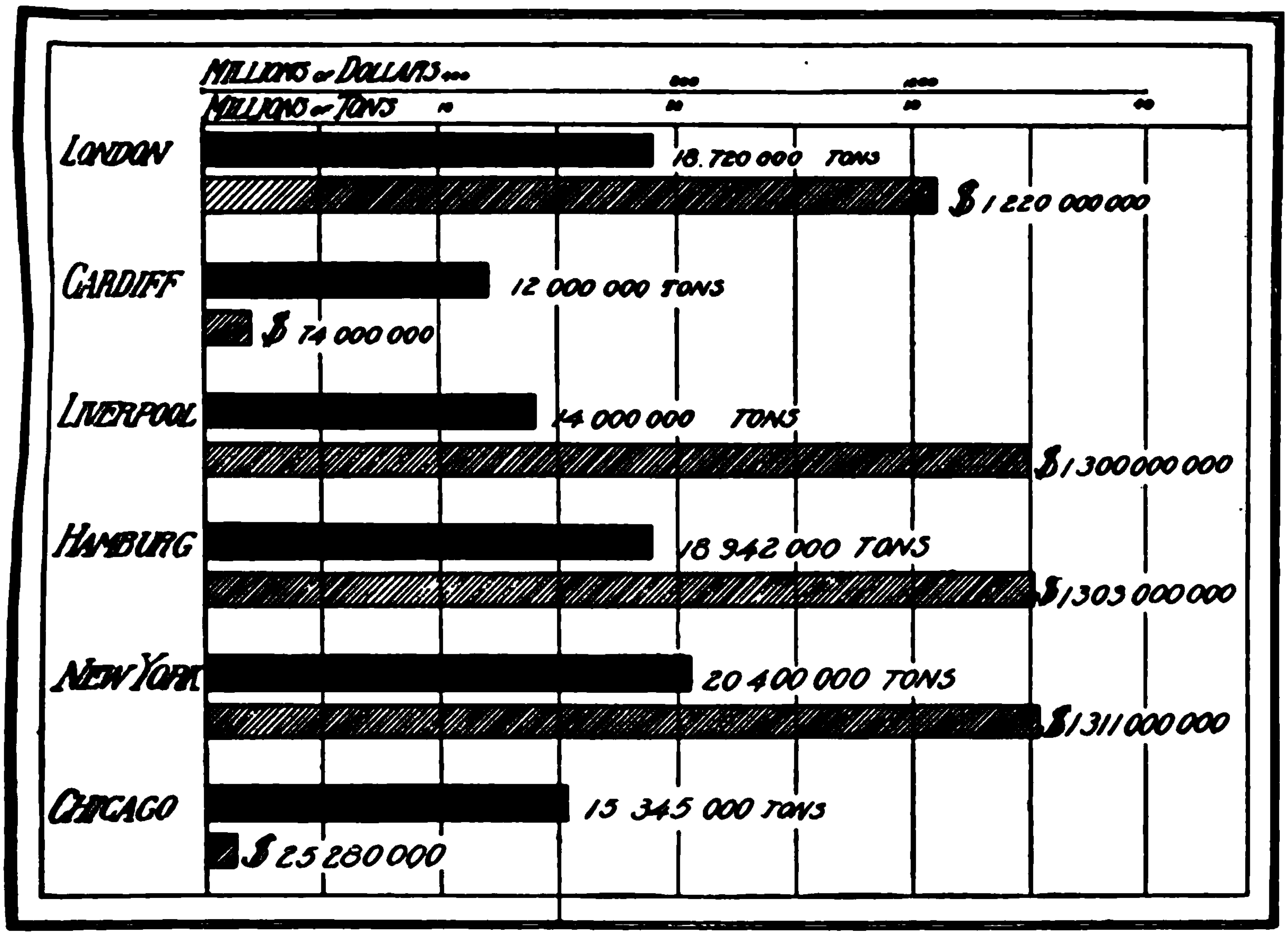


FIG. 242.—Variations in the foreign trades of ports. Comparison of net register tonnage and value of goods. Cardiff is a port for coal and ore. Liverpool for cotton and manufactures. (After J. Paul Goode.)

of the numerous industrial changes brought about during the past hundred years by the application of steam and electricity to so many of man's activities. Its commodities have changed from the small-bulk and high-value goods such as tea, silk, furs, spices, and luxury goods to the cheap and bulky raw materials—grain, lumber, petroleum, ore, and the coarser fibers. Spices, although we use more of them than ever, have gone to the tenth place in the exports of India.

The filling of the channels of trade with the many bulky, cheap, or perishable articles has produced new trade conditions with less dependence upon great ports and distributing centers. Cheap and bulky goods usually go to the best advantage in full cargo lots; and, as the vessel has to depend upon no other freight, it can load at any small port near the place of production. It is easy and profitable for a vessel to go to a small port of Florida or Georgia for a full cargo of phosphate or lumber, to a Chilean outport for nitrate of soda, to a West Indian outport for iron or bananas, to Cardiff, Wales, for coal, or to a convenient railway terminus in the Argentine Republic for wheat. These goods may also be imported by a small port for use in local industries that do not require a large population for the manufacture and distribution of the products. A railway, a pier, and suitable warehouses may enable a small town to export or import raw material in bulk. The raw-material port therefore may be, and often is, a small port.

Relation of Trade in Manufactures to Great Ports.—In contrast to this, only a large city can import or export cargoes of highly manufactured goods. These articles are consumed in small quantities. Much choice is exercised in their selection and purchase by the consumer. The retail dealer must exercise similar care and discretion in the selection of his stock. He can do this best in a great wholesale market where he can go from place to place and take advantage of the competition and variety of stock of many wholesale merchants. This is to be found only in a great city. This gives the city holding the trade in manufactured goods the conservative force that comes of its being known as a market. The trade in manufactured goods therefore continues to cling to the older distributing centers and devious routings long after it is possible to make direct shipments.

The nineteenth-century development has been not so much a revolution as a new growth. The old commerce of 1800, the trade in high-value goods, stays, much augmented, in the old centers; and the new commerce in bulky raw materials goes to them and also directly between small ports. This gives to the trade of almost all ports a one-sided characteristic which has a profound influence upon the ocean-carrying trade. The

ater number of the world's ports are either importing or
›orting ports, and it is unusual for a port to have an equal
.re of each.

	Imports		Exports	
	Total value, millions	Per cent. total U.S. or U.K.	Total value, millions	Per cent. total U.S. or U.K.
v York....	$688	57.6	$701	37.6
ton.......	93	7.8	96	5.1
v Orleans..	42	3.5	159	8.5
veston....	5	.4	161	8.6
. Francisco.	48	4.0	28	1.5
get Sound..	22	1.9	28	1.5
ıdon.......	£209	32.4	£123	23.7
erpool.....	160	24.8	165	31.1
sgow......	15	2.3	30	5.0
mouth....	1.5	.2	.17	.03
fast.......	8.1	1.2	2.4	.4
blin.......	2.7	.4	.1	.01
ndee......	5.7	.8	.9	.1

is is shown by an examination of the table, which shows for ecent year the value of imports and exports of selected ports l the percentages that these bear to the whole movement the nation. New York and Boston, the leading Atlantic ts, adjacent to the greatest centers of population and manuture, are the cities with the oldest and best ocean connections. ey are the leading ports of import and their percentages of ›orts exceed their export percentages. San Francisco, the gateway for imports across the Pacific, has a still greater ess of imports and is in interesting contrast to the newer get Sound ports. The ports of the industrially newer and populous South show the trade in raw materials cut off from trade in manufactured imports. At Baltimore the exports double the imports, and at New Orleans the same conditions

are visible in an exaggerated degree. At Galveston, the newest of the important American ports, the ratio of exports to imports has recently changed a little from a ratio of about 100 to 1.

Export of Manufactures Is Like the Imports of Manufactures.—In exporting manufactured goods there is the same tendency to cling to the old and great port although the tendency is here weaker than it is in the importing of similar goods. The conservative force is the fact that manufactures usually go in small shipments of which many are required to fill a single ship. Add to this the fact that the shipper of goods of this class wishes as fast, frequent, and wide-reaching sailings as possible, and it is evident that he can only get what he needs by doing business through the largest accessible port.

The United Kingdom, being a nation with import of raw materials and export of manufactures, thus reverses the commercial conditions of the United States. The table shows that her small ports, see Plymouth, Belfast, Dublin and Dundee for examples, are importers of proportionately more goods than they export. Indeed, in several cases they export practically nothing and import considerable quantities of the raw products exported from the small ports of America.

Another way of classifying this same division of traffic is to say that the raw-material port is the tramp-ship port and the manufactured-goods port is the line-vessel port.

2. THE WORLD ENTREPOT

The Natural Trade of an Entrepot.—One commercial center can at times distribute a certain product or products to most of the peoples of the trading world and, for those products at least, it becomes a world entrepot. The commodities that lend themselves to this method of distribution must have special qualifications. The goods must have high value, small bulk, and good keeping quality. By having high value the freight rate is relatively insignificant and the long and devious journeys are not a serious handicap. Having small bulk there is not the demand for a whole shipload of them in any one place, and so it is really cheaper to let them wend their way by transhipments through the common distributing center or entrepot. A second

factor of influence is the question of distance. The more remote the origin and destinations of the traffic the stronger is the hold upon this trade of the entrepot with its organization of routes, ready to serve and hard to duplicate.

The trade that best answers to this description and is therefore best fitted to be handled through an entrepot is that from the Orient to the western world. For many centuries it has comprised articles of small bulk and high value—spices, drugs, silks, curios, and tea. These were articles consumed everywhere among the western peoples, but always in small quantities. They were produced in a remote part of the world, and it was commercial economy that they should be distributed among western countries from some western entrepot. The city best fitted to render this distributing service was the one where varied industry had given the most widespread vessel connections. The shifting of this trade from route to route and from center to center is an interesting study of commerce as affected by war, politics, discovery, invention, geographic control, and the economic conditions that resulted from these forces. Owing to this complexity of shifting forces the profits and glory of being the western entrepot of eastern trade have rested in turn with Venice, Lisbon, Bruges, Antwerp, Amsterdam, and London.

The Rise of Venice and Bruges.—During the ordered period of the Roman Empire this unimpeded commerce was divided among many cities. After the fall of the Empire in the West, Constantinople, the seat of the strongest European power became the richest commercial city of Europe and one of the important gateways to the East. Since the decline of the Byzantine Empire some one city has controlled a large share or even had a monopoly of the valuable commerce that passed between eastern Asia and western Europe, and this city has then been an object of envy for the trading world. Venice was the first of the series.

The products of the Orient were brought over the caravan routes through Persia, Syria, and Arabia to the ports of the eastern Mediterranean, whence they were carried by ships to the western Mediterranean. The foremost powers upon this sea were the city republics of Italy. These republics strove among themselves for the eastern trade. These wars were fights to the finish. There were no half-way measures. They

were after monopoly, and the fleets of Venice triumphed, but not by accident. Her economic conditions had given her the best fleets and the widest commercial connections, for the city on the tiny islets had been compelled for centuries to carry in ships every article of food and raw material used by her population. Venice used her advantage to monopolize the eastern trade; and, when necessary, preserved her monopoly by armed force. Europe was compelled to purchase from her merchants silks, spices, perfumes, and other Oriental products. Venice flourished, and bedecked herself with her profits and with the treasures of her victims, so that she is at this moment, after centuries of decay, one of the finest show places in all Europe. One of her assets, if not her chief present asset, is the fact that the people of all nations flock thither to view the remains of her grandeur. In the days of her monopoly the Mediterranean peoples dealt directly with her and regular convoys of precious goods were sent across the Alps and down the Rhine to supply the northern countries. Another part of this northern trade went by the sea routes through the Strait of Gibraltar. But, by land or sea, the chief destination of the eastern cargo was the same—the Netherlands. Here was the greatest center of population, industry, wealth, commerce, and shipping connections north of the Mediterranean. Here also was the "center of all trade between Gibraltar and Finland."[1] For four centuries Bruges had been the metropolis of the low countries, lying securely on the canals that connected the Rhine with the ocean. By 1488 the silting up of her harbor and the increasing size of ships rendered the port no longer accessible, and in that year many of her merchants emigrated to Antwerp on the more open Schelde. Bruges dwindled, and is to-day of interest because she is a mediæval city in the mediæval shell (wall) undisturbed by the swelling growth that has burst and usually razed the wall of every other walled town of west Europe.

The Fall of Venice.—A similar shrivelling fate was in store for Venice. Her ships could ride unchallenged on the Mediterranean and carry back in triumph the pillars of cathedrals from Constantinople and choice products of the East, if they could be reached at any port upon the Levantine Seas; but Venice

[1] Dorn: Die Haven des Weltverkehus, p. 655.

could do nothing with the conquering hordes of Turkish horsemen who overran west Asia and interfered with the caravan routes to India. About the same time, Vasco de Gama, the Portugee, discovered the sea route to India; and in 1499 the first merchant ships that rounded the Cape of Good Hope brought Indian cargo to Lisbon. It is said that the news of the discovery of the new route caused stocks upon the Venetian exchange to decline in a day to one-half their former value. In 1504 the blocking of caravans caused the Venetian fleets to return empty and the proposal, two years later, to build a canal at Suez was prophetic but premature.

The Rise of Lisbon and Antwerp.—Lisbon quickly succeeded Venice as the European entrepot for Oriental products. The Portuguese government monopolized the spice trade and the profits were 400 per cent. Lisbon, however, lacked the requirements necessary for a commercial metropolis. She was not the natural center of a network of local routes that had arisen as servitors of her local industries. She had no local industries of importance; and, as to commerce, she had at best been but the emporium for the comparatively small trade of the Azores, Canaries, and west Africa. While she had been the head station in the sea trade between Venice and the Netherlands, she was but a ship-provisioning place. She lacked the location and the necessary connections for distributing the newly won Oriental products to northwest Europe. Hence, the Portuguese spice importers provided for the distribution of their Indian goods by establishing factories in Antwerp, which had recently succeeded Bruges as the metropolis of the Rhine Delta. While this Lisbon agency business continued, the Flemish manufacturing towns continued to increase in industry and the Flemish metropolis became a market for English wool; for skins, flax, grain, and wood from the Baltic countries; for metals, hardware, glass, and dyes from Germany; for Rhenish and French wines; for Italian brocades; for Spanish fruits; for the products of the Levant, as well as spices from Lisbon.[1] By 1550 Antwerp was the metropolis of Europe, and 2,500 ships lay in her harbor.[2]

The Policy and Fall of Antwerp.—It appears that in the

[1] *Lehrbuch der Handelsgeschichte*, Richard Mayr, p.114.
[2] Dorn, p. 656.

beginning Antwerp prospered above the other Netherland cities because foreigners were free to come and trade at all times, while at other cities they were under restrictions most of the year. At that period it was customary for the leading cities to have annual fairs, when traveling merchants traded on equal footing with the resident burghers. At all other times the foreigner must deal through a local broker. Antwerp was at all times a free-trading city and thither the merchants of Bruges emigrated, there the traveling traders from all Europe collected, and the city prospered until the sieges of the Spaniards closed it for a time, and the final subjugation by Spain in 1585 drove away all who would not subscribe to the Catholic faith. In one year 19,000 people, including the leading merchants, emigrated, most of them to Amsterdam, for the Netherlands were still the industrial center of gravity of Europe and the Netherlanders were the greatest traders. Amsterdam thus became the new entrepot for the disribution of Oriental cargoes, for here, as at Antwerp and Bruges, was a natural center for the manufacturing industries of the Rhine Delta and a natural focus of the routes from the northern shores and the southern shores of Europe, from the British Isles, and from Switzerland down the lordly and busy Rhine. In the next ten years—1585 to 1595—Amsterdam nearly doubled in size.

The Prosperity of Amsterdam and Holland.—The Dutch provinces, being still at war with the now united kingdoms of Spain and Portugal, could not import East Indian products from Lisbon. Accordingly, companies were formed for eastern trade; and in 1595 the first expedition brought the products of the Indies direct to Holland. This circumnavigation of Portugal ended her ninety-six years of monopoly of the shipway to the Indies. Holland, like Venice, clinched her advantages. In the first decade of the seventeenth century, the triumphant Dutch navy conquered most of the colonial empire of Portugal; and the Dutch East India Company practically monopolized the trade between Cape of Good Hope and the Strait of Magellan. To monopolize the supply of spices, the Dutch sailed the East Indies looking for and destroying spice trees so the product of certain controlled localities might comprise the whole crop. The merchants of Holland controlled the trade of the Rhine Valley up to Basle,

and the old Hanseatic posts had in most cases become their agencies. By 1645 the Dutch fleets had a practical monopoly of the North Sea fisheries; they were doing most of the carrying trade of Europe; and, during the English civil war, they even carried the commerce between England and her colonies. In Colbert's time it was estimated that there were 20,000 merchant vessels in Europe, and of these the Hollanders owned from 15,000 to 16,000. Amsterdam became not only the commercial but also the financial capital of Europe and of the world.

The Competition of Holland and England.—The prosperity of Holland brought her into conflict with the rising powers of England and France. In the latter half of the seventeenth century a series of wars with these countries severely taxed her resources. Oliver Cromwell's Navigation Act of 1651 was a direct and severe blow at the Dutch carrying trade, as well as a direct admission that the English could not compete with the Dutch on even terms. By these new regulations only English vessels could engage in the English coasting trade or in the trade with the English colonies. Foreign goods must come to England in the ships of the country producing them or in English ships; and they must come direct, *i.e.*, German or Indian goods could not come via Amsterdam. Further than this, fish that came into English ports must have been caught by English ships. These stringent regulations served to free England from her dependence upon the Dutch vessels, and gradually built up an English marine; but England's position of independence was not exchanged for that of international distributor until her industries made her the greatest exporting and importing nation. For half a century after the Navigation Act was in force Amsterdam was more important than London, and she was a strong rival for yet another fifty years. The Netherlands were the leaders in the textile industries and a potent force in European commerce so long as the system of household labor and hand power prevailed. The age of machinery dawned in England, and with its development came English supremacy. Holland had hands and feet and windmills for driving looms, but England had waterwheels and coal.

England's Industrial Prosperity.—England, free from the wars and disturbances of the continent, and a refuge for many exiled

weavers, had the efficiency of her labor first increased by the use of water-power. Coal was used in the smelting of iron in 1740; and the abundance of these minerals, the bases of manufacturing industry, enabled England to develop machinery, use steam and lead the world in industry. The continuous and destructive wars of the Napoleonic period kept the industries of the entire continent at a standstill, while those of England were undisturbed and rapidly increasing. English commerce and English riches made unprecedented gains because all parties in the continental conflict were compelled to buy English goods. The maritime independence due to the Navigation Acts became naval supremacy through the wars of the last half of the eighteenth century and the victories of Nelson. By the beginning of the nineteenth century England had most of the eastern colonies that had belonged to Portugal, Holland, and France; and the British East India Company had practically succeeded the Dutch East India Company as the conveyors of Oriental produce. On the basis of the best supplies of coal and iron then available, England had, in a century and a half of undisturbed internal peace, become the country with the greatest industry and the greatest commerce. She had as a result the best commercial connections and had succeeded Holland as the greatest international carrier. She was the first country to develop a good network of steamer lines upon the modernizing of commerce after the peace of 1815. Lines went to the Continent and to the United States, and from the days of the old British East India Company there had been frequent connection with the East Indies. With this equipment of commercial routes the leadership of England and the entrepot traffic of London were most natural. In this period she called herself the workshop of the world, for which London was the metropolis, the greatest trade center and the distributor of the products of Asia. The star of Amsterdam had set.

Relative Importance of Entrepot Trade.—But the importance of this intermediary or entrepot trade must not be overestimated, for it has always been subsidiary to the commerce that is essentially local in its origin or destination. This was true of London in 1865 when she was the undisputed world metropolis and it is true in greater degree in the present when her supremacy is

passing away. What London has lost and is losing no other single city or country is gaining. The period of the world entrepot is passing. The later entrepots have had a less binding grip upon the trade than their predecessors held. Amsterdam's monopoly was less complete than that of Venice. The predominance of London was never so complete as that of Amsterdam, and London will not even have any single successor unless some unforeseen elements reverse the commercial tendencies of the present.

Causes of Decline of World Entrepot.—Two reasons will largely explain the passing of the world entrepot. First, the tremendous increase in the bulk of world commerce. The second grows out of the first and is the multiplication of steamship and railway lines which enables many cities to serve as entrepots for limited areas.

On the question of the supremacy of commercial cities, the future cannot be judged by the past. The mechanical improvements of the nineteenth century have made a new industrial and a new commercial world which must be judged by the new conditions.

The great inventions of the present era have increased many fold the materials of commerce. These changes have permitted a rapid increase in population in commercial countries and have brought about the settlement of new continents. The wildernesses of North and South America, Australia, and Africa have become civilized lands having wide commercial relations. Where an occasional trading ship loaded with valuables and trinkets made a bartering cruise in 1800, fleets of steamers assembled in 1900 to carry away the coarse bulky staples of international trade; and, in the first decade of the twentieth century, the progress in this direction has been more rapid than ever. No city could handle it all if she tried; but, nevertheless, England, especially London, had a strong hold during the greater part of the nineteenth century.

Other Nations Rise to Commercial Independence.—When Germany, Denmark, France, Belgium, or the United States wanted small shipments of Indian or Oriental goods, it was convenient and financially advantageous to get these goods in England, because Germany, Denmark, France, Belgium, and

Fig. 243.—The steamer routes of and ports served by the leading Danish steamship company with headquarters in Copenhagen—a rising entrepot.

the United States had regular and frequent connections with England and England had connections with the Orient. After a century of multiplication of commerce, London is still the leader, and richer than ever; but other cities are also distributing the products of the East since they have developed direct connections of their own. Half a dozen British ports have direct lines to the East. German lines go from Hamburg and Bremen, the French line from Havre and Marseilles and the Austrian from Trieste. There are frequent and regular eastern sailings from Antwerp, Genoa and, once a month, from Copenhagen. New York also has regular connection with the Orient, Australia, Cape of Good Hope, the coasts of South America and the ports of the Mediterranean and the Baltic.

As England between 1750 and 1850 established the factory system, built up industrial cities, a foreign trade, and lines of communication, so between 1850 and 1912 have the continental countries and the United States experienced the same industrial revolution and the accompanying growth of cities and of industries. The last and inevitable step in the chain of events has been the establishment of direct communications between the Orient and other ends of the earth to give an outlet and supply for these new-grown centers of industry. The increase of direct connection and the growing complexity of the international trade route net is a pronounced and characteristic tendency of the later decades of the nineteenth century and of the present. England retains her position of independence, but other countries —the United States, Germany, Belgium, Italy, France, and Austria—are advancing toward a similar independence. There is a consequent tendency for each country to raise up its own entrepot. We can indeed see the progress before our own eyes, for the centrifugal or decentralizing forces continue.

Other Cities Become Entrepots.—Hamburg has, in large degree, succeeded London and Liverpool as the basis of foreign goods supply for Scandinavia and the Baltic; but almost before Hamburg is secure in her new trade possession, lines of steamers are beginning to carry the products of America and the Orient direct to Stockholm, to Copenhagen and to the Russian ports. In 1912 a Norwegian company started a line from Christiana to the United States. This trade of Scandinavia and the Baltic

is new and as yet unimportant, but it shows the tendency. Lines from the United States to Genoa have largely displaced trade via Liverpool, and the more recently established New York line to Constantinople and the Levant is cutting off the trade to the United States via Genoa and Marseilles. An examination of port connections the world over will show the same conditions of decentralization and growing freedom from a few great ports that has taken place in Great Britain and the continent of Europe. Two examples will suffice to show the tendency.

The increasing trade of the ports of north China adjacent to the Gulf of Pechili makes it profitable for occasional vessels to take cargo direct from America and Europe to ports of Tientsin, Nuchwang, and Talienwan. A short time ago nearly all of the trade of east Asia was first laid down at the great entrepots of Hong Kong, Shanghai and Yokohama, for final distribution in small craft. As commercial development on this north coast continues and satisfactory harbors are made, there is less and less dependence upon Shanghai, Yokohama, and Hong Kong and more direct connection with the remote bases of supply at San Francisco, Seattle, London, Liverpool, Hamburg, and Marseilles.

Another example oi this world tendency comes from Australia. For many years the sparse population of west Australia has secured the greater part of its European and American goods by the coasting steamers that came from Sydney and Melbourne. Since 1898 the rich gold discoveries have so increased the population and trade that the west coast now receives European steamers direct, and is in large measure freed from its dependencies upon the east coast cities as bases of supply for European goods.

Relative Decline and Absolute Increase.—It must be kept in mind that decentralization does not destroy the old trade center. The statements concerning declining importance are relative, applying to percentage of rapidly growing wholes, and not in any way to absolute quantities. Commerce is increasing with unprecedented rapidity; and the new developments, the new trade routes, are made by and for a part of the new commerce. Meanwhile, it is usually true that the particular trade that inevitably belongs to the old center has also increased and, with it, the city's

prosperity. It is still a distributing center, greater than ever, but for a smaller territory with increased commercial activity. Antwerp now ranks fifth or sixth among the world's commercial cities, being little more than one of the two chief outlets for the Rhine Valley. But she is about five times as large as when she

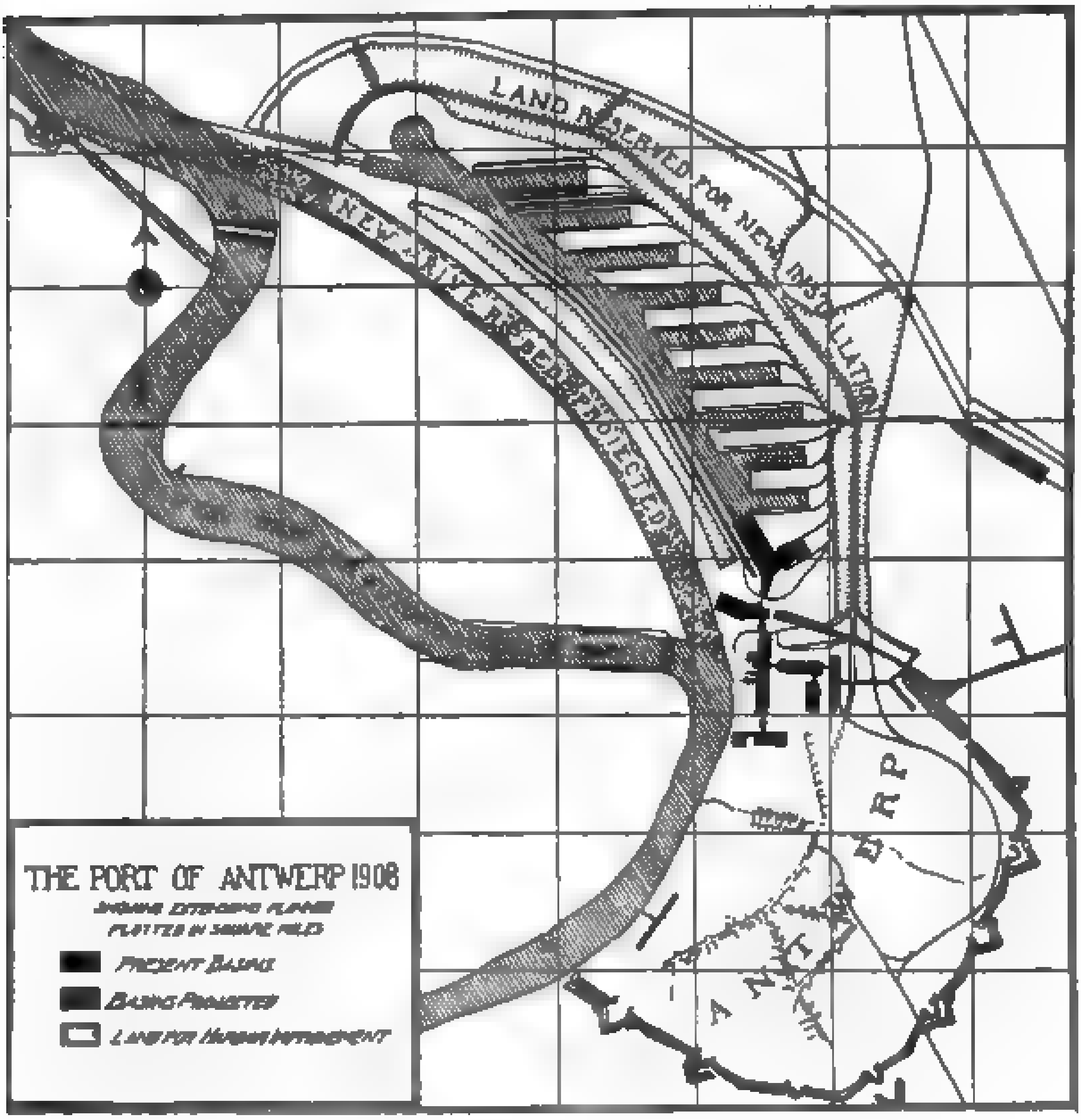


FIG. 244.—Antwerp has outgrown the fortifications put up as defence against Napoleon III and has port plans that are probably unrivalled for comprehensive system. America can show nothing like it. (After J. Paul Goode.)

was the world metropolis, is rapidly outgrowing her new walls, and has under construction harbor extensions that will shelter several times the ships and traffic of her palmiest world entrepot days. No less than $70,000,000 will be required to complete her astonishing new harbor. London's distributing trade has

suffered from the competition of the revived Antwerp, of Hamburg, Bremen, Marseilles, New York, and other cities; but London has millions more of people than she had in 1856 when the first Hamburg trans-oceanic steamship line was established, and after fifteen years of planning $70,000,000 are to be expended in enlarging her harbor. New York handles a smaller and smaller percentage of the foreign trade of the United States, but, as other American cities increase their imports and exports, New York's foreign trade reaches a total greater than that of any other city in the world.

Effect of Grading Goods.—The question of international distributing centers is not alone affected by routes of transportation and the establishment of direct connections. In general, it may be said that commodities having such uniformity as to be accurately graded and sold by grade, can be and are sent directly to their destination with little regard to the entrepot, while commodities that cannot be accurately described but must be inspected before purchase are often bought and sold at some convenient intermediate point which has come to be recognized as a "market" for a certain commodity or commodities.

Wheat is an example of the gradable commodities. A buyer is reasonably certain what he will get when he buys No. 1 or No. 2 of a certain kind of wheat, graded in a certain market. Accordingly, ships load in California, Argentina, or the Atlantic coast of the United States or Canada and start toward Europe. The cargo is sold by telegraph, and the captain of the ship learns his destination by signals as he passes the Madeira Islands, or some point on the English or Irish coasts.

Effect of Ungradable Goods.—Such transactions are impossible with the ungradable articles of which wool and ivory may be taken as examples. The value of these commodities is affected by so many conditions that they must be examined before being purchased. The sheep's fleece is often cut into five or six pieces at the shearing table and the wool bale of commerce contains only one of these kinds. The value of the bale depends upon the skill of the wool baler on the sheep ranch. It also depends upon the breed, the ancestry, and the food of the sheep, which affect the length, fineness, and strength of the fiber. The character of the soil in different localities gives the raw wool a varying pro-

portion of dirt; the heat of the climate and the variations of the seasons give it a varying percentage of grease; a drought and accompanying shortage of food reduces the physical condition of the sheep and makes a weak place in the fiber. The wool buyer needs to consider all of these factors in purchasing. He must, therefore, see and feel of the wool before buying, and a mistake in judgment may cause large financial loss. The wool buyer is a highly paid expert and it has always been profitable for the wool manufacturers of the United States, England, and the Continent to secure a large share of Australian wool (the highest grade of wool) at the London wool auctions, where inspection is easier than in Australia.

Ivory is likewise of uncertain value. The age of the animal and the size and the previous treatment of the tusk, are important factors, and an almost imperceptible fracture may nearly ruin an otherwise perfect piece. Ivory is, therefore, sold by auction. The greatest market is Antwerp, the greatest supply coming from the Congo region.

Conservative Influence of an Established Market.—Commodities requiring inspection are not necessarily sold at auction. Private sales may give as firm a hold on international trade, once a city becomes the recognized place to buy and sell certain commodities. The entrepot has a prop in that peculiar and conservative force—the drawing power of a "market." The drawing influence of an established market causes some cities to handle large quantities of goods which might now be handled to better advantage and with less labor elsewhere. The "market" often holds its trade in this day of direct connections by the force of mere custom and conservatism. Such is the Bremen tobacco market, which began with the establishment of a line of emigrant ships to the United States in 1827. At that time tobacco was almost the only return freight, and Bremen became the greatest European tobacco market. "Bremen is the market for hogshead tobacco, and everybody buys here." Such were the words of a Bremen tobacco merchant when asked as to the cause of Bremen's control of the continental tobacco trade. Later came cotton, rice, grain, and petroleum, and its importance in the rice, cotton, and tobacco trade continues till the present. The fact that this city is a great rice market and had good eastern and western

steamer connections long caused her to forward to the United States some East Indian rice that might just as easily have gone direct to New York. In comparison with Bremen, Hamburg has better steamship connections and decidedly better interior transportation; but Bremen holds the tobacco market and the cotton, rice, grain, and petroleum markets, although Bremen cotton firms have tried to open branches in Hamburg, with the idea that they might eventually move to that city. The Hamburg branches failed just as have the efforts of London wool brokers to sell Australian wools (fine wools) at Liverpool auctions. In the same way the Liverpool brokers have failed to sell carpet wools (coarse wools) at London auctions. The cause of these failures may be ascribed to the price-setting function of the established auction or market. In each of the above cases the goods offered in the unusual places were offered at reasonable or even very favorable rates, but the buyers made unreasonably low bids, and later they often paid more for the same goods at the established place. At the unusual place the buyer has the uncertainty of thinking that he might get a better article or more favorable price at the regular market with its larger stocks; so he bids cautiously. In the regular market he knows that here all sellers are bidding for his trade, and he buys. It is a kind of a supreme court of commerce

Effect of Abundant Capital.—The capital of the entrepot serves as a prop to maintain its hold upon trade that might by existing direct connections go direct from producer to consumer.

The business of the international distributing center therefore increases or decreases with changes in the financial soundness and available capital of the trading countries. The merchants of the great center by having stocks of goods may, in a sense, serve as the bankers for, or partners with the traders of countries where capital is less plentiful. Hence, as capital becomes more plentiful in the various countries, there is less need for and dependence upon the center. The German or Belgian manufacturers may not have the capital to invest in raw materials that must be purchased in South America or Asia in large quantities and weeks in advance, even if such purchases are desirable. Steamship connections make such a trade possible, but it may suit the manufacturer better to buy in London or Liverpool in small quantities

as needed. A few years ago many German woolen mills had established a direct trade in Argentine wools, to the detriment of the British merchants who had previously supplied them. Financial difficulties in Germany brought failure to a number of German mills and reduced capital and credit to others. The direct purchases in South America had to be discontinued and a larger share of the wool supply again came through the centers of abundant capital—London and Liverpool. This case is an exceptional one in a time when the general tendency is toward the increasing financial independence that fosters direct trade, but it serves as a forcible illustration of the influence of abundant capital on the entrepot trade.

The history of the Liverpool cotton market illustrates this general tendency. Three or four decades ago two-thirds of the American crop went to Liverpool, 2 million bales were often carried in stock, and the world price was fixed in that city. As the American dealers could not afford to store and hold it, they exported it as rapidly as possible, and, in a few months, the whole crop was disposed of. The continental buyer could not afford to send to America for it all at once, but took advantage of British capital by buying in small portions in Liverpool. But capital has become more abundant in the regions of cotton production and cotton consumption, and there has been a corresponding decline in the international importance of the Liverpool cotton market. American mills consume a larger share of the annual crop; American capitalists are able to hold the raw product; American speculation and American consumption set the world price. In many cases the cotton spinners of the continent buy directly from America; and Bremen, Havre and Antwerp are rival markets with Liverpool. Some hasty purchases or small purchases are made in Liverpool, but the relative importance of that city has declined; instead of importing two-thirds of the American crop her dealers now handle but one-third and instead of two million they now only carry one million bales in stock.

The Entrepot Problem Is Universal.—The restraining influences are but exceptions in a general tendency. The day of the world entrepot has passed and its place is being taken by an ever-increasing number, so that we now have a score that are as large as was Amsterdam in her distributing prime, each handling as

much trade as she did in that day. But the fact remains that of the many, many thousands of towns and cities upon the face of the globe, all but this favored score connect with the great arteries of commerce through some entrepot of greater or less importance. Therefore, it is plain that the problem of the entrepot is universal and their number merely serves to heighten interest in them. The towns that are small, the cities that are poor, and the countries that are undeveloped can get the myriad good things from the remote lands, the different climes, and the scattered mills and factories only through some entrepot that has established its connections with the ends of the earth.

New entrepots are springing up all the time; but they come in response to economic law, not legislative statute or personal or national whim. If these laws had been better understood, the American people would not have been so sure in 1898 that Manila was a good place from which to control the commerce of Asia. Manila is not, and, under any feasible conditions of commerce, cannot be an entrepot for Asiatic trade. It can neither assemble nor distribute the trade of that continent with either America or Europe. It bears almost exactly the same geographical relation to the mainland of Asia that Havana does to the mainland of North America. To make Asiatic entrepot matters worse, Manila is the most distant port of Asia except Singapore. Some of the lines from America have added Manila to their list of ports; but it is the end port of the voyage, which naturally takes the ship first to Yokohama, next to Shanghai, then to Hong Kong, and finally to Manila. Manila is the metropolis and natural entrepot of the Philippine Islands. It can be to them what Copenhagen is to the scattered isles of Denmark, what Honolulu is to the Hawaiian group, what Havana is to Cuba—the place where their products will be assembled, the place where great ships will unload cargo for distribution by smaller vessels to five hundred smaller ports, roadsteads, and wharves. As the Philippines prosper, Manila will prosper. If the American Congress throttles Philippine industry, it throttles Manila's trade which handles the products of that industry. In any case, traffic that seeks Asia will go to Asia, whether the Philippines prosper or decline. Hong Kong, Shanghai and Yokohama are Asiatic entrepots, but giving way to newer and smaller ones closer to centers of production.

CHAPTER XIV

THE WORK OF THE TRADE CENTER

1. THE BARGAIN CENTER

The Buying and Selling of Distant Commodities.—A city may be a commercial center in two ways—first, as an actual distributer of goods; second, as a transaction center, a place where bargains are made for goods that are elsewhere and which may never be brought to the center. The transactions in C often relate to goods in A to be sent directly to B. The transaction center is the lineal descendent of the eighteenth century distributing center. In the days when the communication of ideas and the carriage of goods depended upon the slow and uncertain sailing vessel, or the equally slow and uncertain means of land conveyance, it was usually necessary to have the goods on the spot before they could be the subject of bargain or sale. However, the steamship, the railway train, and the telegraph have made a commercial world, new in its methods of management as well as in its staple commodities. The telegraph gives instant and constant information concerning stocks on hand, the crop prospects, and other conditions that affect the prospective supply. The steamship gives quick delivery; and, what is of equal importance, it far exceeds the sailing vessel in the certainty of reaching port in a stated time. Commercial transactions of to-day may thus concern commodities in distant places and for future dates; and, although the movement of the goods may be decentralized, it still remains advantageous for the men doing this work to assemble in groups at some convenient center.

Advantages of Centralized Bargaining.—The sales and purchases are made in the center because it is easier to carry on such operations where many buyers congregate, where many compete in the same business, and where representatives of many businesses can serve each other. This attracting force is somewhat akin to that of an auction and it draws those engaged in the bar-

gaining or transaction side of commerce into groups that are often quite irrespective of the location of the commodities in which they deal. This centralizing force operates in local, interstate and international trade. It is usually strong enough to collect into a small district of a city all the firms engaged in the same line of business, provided the business is not of the retail nature requiring scattered location close to its patrons. The steamship agents and brokers of London, Liverpool, New York, and Philadelphia are all collected into small districts of their respective cities through which one can walk in a few minutes. The London wool brokers have their still more restricted locality, and two or three small streets are the headquarters for the general produce brokers. The same is true of the leather merchants of New York and the paper dealers of Philadelphia. An hour's walk through the wholesale districts of New York, Philadelphia, London, Hamburg or any of the many smaller cities will suffice to give the observer many examples of this grouping of mercantile firms engaged in the same business.

Examples of Centralization in Bargaining.—The exchange, of which the stock exchange is a conspicuous example, represents the highest form of this grouping or centralization. There the principal buyers and sellers of a particular commodity actually congregate in a single room to facilitate their work. The exchange method of doing business may be applied to most commodities of which the price may be quoted. London recently had nine exchanges—a stock exchange, a wool exchange, a metal exchange, Lloyds, the underwriters' exchange, the corn exchange (grain), the coal exchange, the royal exchange (bankers, manufacturers, etc.), the shipping exchange, and the Baltic, an exchange where all commodities are dealt in, especially grain in full cargo lots. New Orleans, Liverpool, and Bremen have cotton exchanges; Louisville has a tobacco exchange; and Leipzig a book exchange. Hamburg has one very large exchange attended by most of the brokers and wholesale merchants of the city. A variety of transactions take place, but the grouping principle works within this general Bourse or exchange, for there is a steamship corner, a grain corner, a coffee corner, a stocks corner, etc.

By similar centralization the manufactured products of an industrial district are usually sold at some central point to which

in many instances they are never sent, being shipped instead directly from the factory to the point of final destination. Manchester is the selling center for the cottons produced in a score of smaller cities and towns in Lancashire. Offices in the business section of Philadelphia sell a large part of the manufactures produced in the mills of the suburbs and near-by towns. The same is true in Boston and many other large cities.

National Centers for Management of Foreign Trade.—In the same way the transactions of foreign trade are centralized in the commercial metropolis. Decentralization of commodity traffic has been an accompaniment of the growth of the new commerce; but the telephone, the telegraph and the fast mail have helped to keep up the transaction center by putting the selling agent in easy communication with the factories and local centers of the producing and consuming districts in all parts of the world. Sales for the foreign trade or to the distant consumer cannot be easily arranged from cement works located in the Allegheny Mountains of Pennsylvania or Virginia, from the Georgia cotton mills, or from the phosphate mines of Tennessee or Florida. Consequently the selling agencies are in New York, although the cotton cloth may go to China by way of Vancouver Sound, the phosphate is shipped from a gulf port to Japan and the Virginia cement reaches the sea at Norfolk and Newport News, or goes by rail to interior points. The products of the scattered industries of Great Britain are largely sold in London, but tens of millions of pounds sterling worth of the goods thus sold go from the point of production to Liverpool, Hull, Glasgow, Bristol, and other ports for export. Hamburg merchants or brokers sell a large share of the German export manufactures while they are yet in the mill, and the goods in question often go down the Rhine to Antwerp or Rotterdam for shipment. The Paris commissionaire renders a similar service in the French export trade, and in many countries the broker who makes a specialty of selling for many persons or firms brings about an important part of the transactions in foreign as well as domestic trade. There is a general tendency toward the establishment of direct connections between consumer and producer, especially when the currents of trade have become regular and confidence is established; but the markets for the new industries or the new lines of trade in

many of the old industries are found through the agencies of the selling center. Here also the new purchaser usually finds it is easier to purchase his stocks, and at all times the individual trader dealing directly has the opportunity to better his condition by selling through the transaction center and getting the advantage of a competitive market.

International Bargain Center.—The transactions of the wider international trade are also centralized. London, the last great international distributer, is still a large international seller. With the convenience of telegraph and cable the London distributing merchant often found that, upon the founding of direct communications between foreign countries, he could continue to hold the business although the goods no longer passed through London. He knew the conditions of both eastern and western markets, and the direct connections that have sprung up merely enabled him to deliver more quickly by shipping his goods direct. By this process, London has come to be a dealer in goods which may never at any time be within 5,000 miles of England. For example, London brokers and London merchants recently had a practical monopoly of the international sales of pepper, Manila hemp, Indian jute, and Burmah rice (the chief supply for the world market). The world's supply of each of these four commodities is produced in a comparatively small region and consumed all over the world. The high value and limited supply of the annual crop would probably lead to disturbing price fluctuations if the central London firms did not act as a sort of regulator. Being in constant communication with their numerous agents in the centers of production and consumption, having a world knowledge of this particular trade, they are able to conduct business more safely than is the firm in New York or Marseilles, should it attempt to buy hemp, jute, or pepper directly from the dealer in the point of shipment. Under such an uncentralized method no man or set of men would have the knowledge of conditions in the producing and in all of the consuming centers; and it is probable that some one of the several centers of consumption would get too large a proportion of the annual crop to be successfully sold in its established markets; or it might by delaying purchase get too small a supply, producing scarcity and abnormal prices; or again the entire crop might not be purchased and a surplus

'ould be left to disorganize the next year's market. But as it is, ae London firms have a geographical location that is central to ae consuming regions of Europe and America, and because of aeir knowledge of the requirements of each section the business conducted much more evenly. A financial disturbance or ilure in Spain or Holland or Sweden might cause the sacrifice f a shipment of pepper that had been purchased and was in 'ansit. The Spaniard, acquainted only with a small local trade, 'ould lose heavily by a sudden forced sale; but, if the London ouse had charge of the transaction, the shipment in question 'ould be transferred to the next best market, which might be in ie United States, in Scotland, or in Russia. It sometimes appens that such sudden changes return to the broker's control oods that can be disposed of to good advantage in some other lace where a new and unexpected demand has arisen.

The commodities that are subject to the centralized control of ondon sometimes go by London, Liverpool, or Hamburg for onvenience of trans-shipment to final destination in America or urope, but they more often go direct. For example, the Burmah ce goes in full cargoes from Rangoon to Chile, Brazil, and the 'est Indies.

The direct shipment does not seriously affect the position of the ondon firms. A representative dealer in Manila hemp said that ome hemp bound for America is still trans-shipped in London, ut that the United States tariff arrangement giving a reduction a hemp imports shipped direct from the Philippine Island would op this circuitous movement but would not in any way interre with the London management of the bargaining end.

The Influence of Capital.—The international transaction enter requires a central location, a line of business that is carried a in widely separated places, and, in addition, an abundance of ipital. Capital must be more plentiful in the center than in the ommercial outposts, for the central management of distant usiness operation is only possible by the use of capital from the ontrolling center. In this respect the relationship to the stributing center is again shown.

The London firms can only hold the fiber trades by buying the emp in Manila and the jute in Calcutta. The rice firms hold ie cleaning mills in Rangoon and the other ports in Burmah.

This central control goes further and sometimes takes a lien on the unharvested crops. The white grapes of southern Spain are usually sold in or through London to offset the account of the merchant-banking firm that has, through its local agent, advanced the money necessary for the expensive oak casks and cork packing. An American importer of these grapes bewailed his inability to buy them direct from Spain, but he could not break the hold of the English money unless he had a bank in Spain. He was not a banker so he got his grapes in London and sent them across on the fast trans-Atlantic liners at little if any sacrifice of time or freights. The super-abundance of London capital gives the London capitalist a controlling voice in the sale of many products.

Close Relation to Banking and Industrial Enterprises.—The distant agents for London firms have brought and are bringing to London a great variety of transactions similar to the above. Further examples may be cited in the Persian wools, the dates of Arabia, and the cabinet woods of Mexico and the West Indies. The details of an actual case will illustrate this class of transactions. A German firm, half merchants and half bankers, has head offices in Hamburg and branches or agencies in many other cities, among them a port in the Tehuantepec region of Mexico. In this port there was a Mexican promoter. He had a concession from the government to cut mahogany in the woods of the interior; he was familiar with the language of the Indians and with the local labor market; but he had no capital. He arranged to get the necessary money from the banker's agent who was acquainted with the conditions and took the risk as follows: First, the promoter was bound to deliver certain amounts of mahogany as collateral for a certain sum of money for which he was to pay a good rate of interest; second, he was to receive the money in monthly installments as the work of getting out mahogany advanced; and, finally, the agent was to sell the wood, thus securing the payment of principal and interest—provided it brought a sufficiently high price. This was of course a part of the risk incurred in advancing the money. When the work was so nearly done that a date could be set for its conclusion and for the shipment of the lumber, the agent informed the head office in Hamburg. The principals entered into negotiations to secure transportation, and finally chartered a British sailing vessel to

load a full cargo and proceed to the English Channel for orders. In the meantime, efforts were made to sell the cargo but as no suitable buyer could be found in Germany, it was placed in the hands of a London broker who sold it to a Paris firm who ordered the vessel to proceed to Havre and discharge cargo.

As the trading countries come to possess more adequate supplies of capital for their own use, and when the trade assumes larger proportions, the international transaction center loses, at least proportionally. When the buyer and the seller can manage a transaction without mortgaging the goods in transit to a financier in a third country, there is less need of the services of the broker in the international transaction center. There is accordingly a tendency toward a decentralization of management as well as a decentralization in the actual handling of goods. But the two decentralizations do not accompany each other. The direct movement of goods preceded in point of time the direct management of the business. The latter may be indefinitely delayed. The supplies of capital may remain low, causing dependence upon foreign bankers. Few countries have or promise in decades to have sufficient capital for their own needs. Since the commercial character of the traders in some countries is not reliable, no one dares trade with them who is not fully acquainted with them—which usually means having an agent on the spot, as happened in the Mexican lumber incident described above. The trade of some countries will therefore continue to be largely transacted through the centers in the financial countries, although many products (usually the raw materials) go directly to the ports nearest the points of consumption.

In the United States the industries are conducted upon an unprecedented scale, the mercantile classes are relatively reliable, and the accumulation of capital has been rapid. As a result direct bargaining arrangements have been established, at least for the staples of American trade. There is no single European center for the trade in American grain, cotton, or lumber. American merchants deal directly with half a dozen European cities. Sometimes a London broker succeeds in placing a cargo of American grain or lumber in some other city, but this is unusual and he must divide his brokerage with the agent in the other port. The Russian grain cargoes from the

Baltic and Black Sea ports are usually sold by London brokers, although they may go to any continental or British port. The same is true of East Indian teak, West Indian mahogany, and a large share (some merchants estimate it at a half) of the Brazilian coffee that goes to the Continent.

Direct Control of Distant Industries from the Bargain Center.—There is still another stage in this bargain center control, the entrepeneur stage. The capitalists, usually European, actually carry on industries and manage them and sell the product through the headquarters in the capitalistic center. Hamburg is the market for the German coffee plantations of Guatemala; Amsterdam is the chief market for the Sumatra tobacco grown in the East by the Dutch companies. The Jarri paving-wood industry of western Australia is all managed in two or three buildings in London. London has thousands of companies doing business abroad, and, if one walks through the business districts and reads the signs upon the office buildings, he can familiarize himself with geographical names in every continent, in almost every country or island with resources to develop and with an adequate capital.

It should be emphasized that this capitalistic development has but begun. A mere corner of the world, say a half million square miles or one per cent. of the earth's land surface, has capital to spare; and all the vast remainder of the world must depend upon imported capital for the execution of any considerable enterprise; such, for example, as the building of a railroad. This is true of the entire continents of Asia, Africa, and South America, the East and West Indies, Australia, Central America, Mexico, Canada, and most of the United States. We still use large amounts of foreign capital, although some of the American people have now begun to invest abroad, and there has long been much control of industry in our western states by Eastern capitalists. Throughout the nineteenth century the countries of northwestern Europe were the sole exporters of capital, and Spain, Italy, Greece, the Balkan States, and Russia are still borrowers.

The borrowing countries are in different degrees of poverty; some are much nearer financial independence than others. Australia and India are much richer than Persia or Central

America; but, taking the world as a whole, there is every indication that during the most of the twentieth century a comparatively small proportion of the world will furnish the capital that will be distributed throughout that part of the earth's surface that contributes commodities to world commerce.

The Rise of International Bargain Centers in the United States.—The United States will join Western Europe in capitalizing the world's new enterprises and the financial centers of these countries will be the centers of control of industries in the other continents. As the continent gains relatively on England, Hamburg, Amsterdam, and Paris will continue to rise in importance, while New York promises to take a leading position. This is well shown by the present dominance of that city in the industries of America. There is the headquarters of the United States Steel Corporation, a veritable kingdom in riches, in numbers of persons dependent upon it, and in the scope of territory owned and covered, for its engines throb and its machinery roars in the states that border Canada and the Gulf, the Pacific and the cold New England Atlantic. In New York are consummated the deals in Montana and Arizona copper, Oklahoma oil, Maine spruce lands, Georgia pine lands, Susquehanna water-power plants, Virginia railways, Florida phosphates, West Virginia coal, Pennsylvania cement works and the chartering of ships for Galveston cotton. Most of the railroads of the country have offices there and those who supply them must also have offices there. The list might be drawn out indefinitely, for there is not a state or territory in the Union that does not have lands, enterprises and resources managed from New York, the bargain center of the American people.

As this country grows richer and has capital to invest in foreign lands, the office signs of New York become more and more of a gazeteer of the world. The future is suggested by the important place taken by New York in the industries and railways of Mexico and by the Guyaquil-Quito railway which was built by an American company that has its headquarters in New York and did not even list its stocks on the London exchange. New York manages the banana business of the Caribbean countries and the asphalt business of Trinidad and Venezuela, and is striving for a chance to help build railways in China.

Other American cities will engage in similar distant enterprises. The era of bargain centers is but begun.

2. THE WORK OF THE MERCHANT OR MIDDLEMAN

Function of the Merchant and of Money Compared.—Merchants carry on the world's commerce, which consists in buying and selling and carrying. The merchant and money are twins, both called into being when primitive commerce becomes too elaborate for direct barter. While a community and its economic life are so simple that producers can supply themselves with goods by exchanging directly with each other, they use no money, and there is no merchant. But such conditions of simplicity can only exist in a savage community of low forms. To-day most savages use commodities produced by men they have never seen. In these cases money (gold, silver, shells, wampum, pieces of leather, checks, drafts, promises, anything that is agreed upon) serves to transfer the value from one community to another, from one man to another. The herdsman with twenty cattle, fifteen of which are of no value to him if he himself must use them, stores their value in shells or beads, or gold given by some merchant until he can exchange it for furs or weapons. As the money serves to transfer the value of goods, so the merchants transfer the goods themselves and make the link between two producers each unknown to the other.

Kinds of Merchants.—As trade becomes more extended the merchant cannot himself know both producer and consumer and another class of merchant arises—merchants who sell to other merchants. With the growing complications of society this process is repeated so that in the present international trade goods sometimes pass into the possession of eight or ten different merchants before they reach the consumer. Some of these merchants perform but a small part of the process of connecting the producer and the consumer, for some mercantile operations are divided into sharp and narrow specialties. With all their variety of work the whole group of merchants may be divided into two classes.

(*a*) Those who only sell goods for other people.

(*b*) Those who own the goods they sell.

The man or firm owning the goods is commonly regarded as the real merchant, those who sell for others being known as commission merchants, brokers, agents, etc., but their service to society and their part in commerce is the same. The question of the ownership of the goods being sold is a minor detail; the selling is the important part.

The Commission Merchants, Brokers and Agents.—The merchant who sells goods for other people is a result of widened and well-established commerce. He is to be found in all large centers of domestic or foreign trade, and his chief capital is his knowledge of and acquaintance in the market in which he sells. Some familiar examples are the farm produce commission merchant, the stockbroker, and the real estate agent. In the medium sized and large cities of America and Europe, the farm produce that cannot be sold by the farmer himself[1] is sold by commission merchants to whom the farmer or local dealer has consigned it at his own risk. The merchant has no capital involved except the warehouse and necessary appliances for handling the goods. He is acquainted with the local dealers in his particular line of goods, sells the farmer's produce on the best terms he can, and receives his pay in the form of a percentage commission. The stockbroker goes to the stock exchange, and buys and sells securities for his clients on commission (called brokerage). The money broker takes advantage of his knowledge of the money market. Knowing the reliable borrowers and also money lenders, he arranges loans between these parties and receives a small commission. People having lands or buildings which they wish to sell or rent, go to a real estate agent who finds purchasers or tenants, and receives a commission on the purchase or rental money.

Brokerage or commission transactions are quite as important in international trade as in domestic trade. Every city that is a "market" in international trade, such, for example, as London, Liverpool, Hamburg, Antwerp or Havre, has many brokers who have an international clientele. Sometimes they handle a certain class of articles; often only a single article. Sometimes a firm of brokers has several members and a staff of clerks, and yet deals

[1] By a needless separation of producer and consumer world commerce has greatly and uselessly raised the cost of living.

in but a single article as wheat, rice, tea or coffee. It is common for the brokers of a city who deal in the same article or articles to form an association for their mutual advantage and for the publication of statistics. London has a Rice Brokers' Association, Liverpool a Cotton Association, a General Brokers' Association and others.

The auction sales of London, Hamburg and other cities are but a species of the commission merchant's work. The work of the international broker or commission merchant is similar to that of the local or domestic broker mentioned above, except that the operations cross international boundaries and are spread over a wider area.

Within the city of London, a business custom has developed whereby certain classes of brokers perform a unique function. They effect transactions between merchants who may be in the same building. This is not because the merchants are unacquainted. For want of a better name, the advantage may be called diplomatic. The Briton explains it thus, an explanation which shows the reason that causes many transactions in all cities to be arranged by third parties. If merchants or their acknowledged representatives should meet daily and haggle over prices, set them, change them, promise, threaten and withdraw their threats, there would be a certain amount of friction and personal hard feeling which is not a good basis for continued profitable business relations. Therefore, they make the transaction impersonal by employing a broker. He goes to the merchant and offers to secure certain goods at a certain price. If the price does not suit, the broker may change it later in the day or he may find another purchaser. But in any case the broker is not responsible; he is but the agent. Whose agent he is, the merchant does not know, for any broker may sell goods for twenty-five or ten or maybe a hundred merchants. He is not the representative of a firm, but rather the representative of impersonal goods, and this impersonal aspect of the transaction keeps every one in a good humor. The practice really results in the merchants having fewer regular salesmen employed, and expanding their force when necessary by the employment of the professional salesman, the broker.

The Selling of Manufactured Goods.—The brokerage and

ublic commission business is better adapted to simple and nmanufactured commodities than to the more elaborate manu- ictured goods that tend to be suitable for particular markets nly. With the exception of real estate and stocks, all of the camples cited above were of articles moving from the district f raw material production toward the industrial center—farm roduce going to the city, foods and raw materials going toward ie manufacturing and consuming regions of Great Britain, ie Continent or the United States. In the case of manufactures, hich constitute the bulk of European, and a growing share of merican exports, the more exacting demands of the market equire more organization for successful selling. Goods are ften sold on commission, but it is done by a regular authorized gent who is often the representative of but one manufacturer r group of manufacturers, although he sometimes sells for everal concerns. The sales agent and the export commission ouse serve the distant manufacturer just as the commission ierchant serves the distant farmer. The export merchants › whom they sell are in their turn the great rivals of the sales gent and the export commission house. The export merchant ever striving to get away from both these bargain center illers, and by establishing direct dealings with the factory, void the commissions of the intermediary.

The Export Merchant.—The export merchant performs an nportant and interesting part in international trade, especially etween the manufacturing countries of the north Atlantic nd the distinctly raw material producing regions of Asia, frica, Tropic America and Australia. A firm that buys in urope and sells in Chile or Australia, or both, covers a wide rea. The method of organization is somewhat as follows. 1 the selling country the firm does business as a wholesale ouse which may carry a large stock of goods. As the value f an established business of this sort is great, the business, prosperous, is rarely discontinued and is often passed intact om father to son, from partner to partner, from founder to urchaser for generations. These merchants or merchant rms often aim to deal in every line of goods required in such a puntry as Argentina, Chile or China. Distributing branches re established and the area of operations increased until some

from Boston, Puget Sound, or Montreal. An extreme case is that of the London firm that, having no American branch, purchased by cable a lot of provisions in San Francisco and ordered them shipped by direct steamer to Hong Kong where they were trans-shipped to Singapore, the selling center for this particular firm.

The Position of Americans in International Trade.—The first trader in the field has a strong advantage over his later rivals. The force that comes from an established trade with regular customers, a good name and wide acquaintance makes it difficult for the new merchant to get started. As a consequence of this advantage of an early start, the mercantile organization shifts much more slowly than the world's industrial or exporting center. The British merchants, the first in the field, have simply bought German and American goods when they became available, and supplied them to their old customers. The German merchant has now gone abroad and is making strong competition with the English, but the Americans have scarcely begun to compete for foreign trade. The great boom in American exports that occurred between 1897 and 1902 was not accompanied by a corresponding increase in the work of the American merchants doing business abroad. The merchants of other countries, finding our prices low because of industrial depression, bought the goods and sold them again. The development of American mercantile enterprises will come in time, but it is the second step. The first step—the development of the vast domestic resources and the supply of the home market—has thus far occupied most of the enterprises and capital of the American people who, in the main, care and know but little about foreign commerce.

CHAPTER XV

BALANCE OF TRADE AND ITS RELATION TO INDUSTRIAL DEVELOPMENT

ıition and Significance of Balance of Trade.—Balance of ı the term usually applied to the difference between the on of goods imported into and exported from a country. to the concepts of a discarded theory of political economy ss of imports is called an unfavorable balance of trade excess of exports a favorable balance of trade.

e is such a variety of causes that the excess of exports orts can have no uniform significance and therefore no ınce beyond mere excess in value of the one over the other. ess of exports, the so-called favorable balance of trade, ndoubtedly mean some credit abroad. It, therefore, ably means that the exporting people can meet their obligations and are therefore solvent, but it will not do the figure on and suppose that upon the average it means or the nation or the individuals of the nation having this d favorable balance. It means more often a moderate proving state of indebtedness. Nations are made of ıals. To see the trade balance in its correct light compare individual's financial and industrial condition.

old gentleman retires from Wall Street or London to a onial estate in Virginia or Surrey and from it sends out y $3,000 worth of produce and has sent to it annually worth of produce, no one speaks of his condition as being able. His neighbors know he is rich enough to live upon ey so that he can sell few things and buy many. Alongıim may live a farmer with a mortgage on his farm. He ,000 worth of produce and owing to his heavy interest ts he only has the money to buy back $2,500 worth of .

se two men were types of groups large enough to be called

nations, common custom would say that the farmer who was laboring against the mortgage had a favorable balance of trade when in reality he is working arduously, selling the eggs he ought to eat, and going without a new roof on his house; and common usage and terms would have it that the comfortable, rich old gentleman had a very unfavorable balance of trade. As a matter of fact, he can order and pay for the products of all lands. The terms favorable and unfavorable balance of trade are at times ridiculous contradictions, if they are meant to convey the idea of national riches. Excess of exports and excess of imports would be much better terms, because they do not have further implied meanings tending to mistaken concepts. Excess of import or of export is produced by too many different and at times contradictory things to be so simply and categorically defined as favorable and unfavorable.

Relations of Money and Bullion to the Settlement of Trade Balance.—There is a widespread failure to recognize the fact that the balance of trade is eventually paid, paid in goods and paid only in goods. It seems difficult for the business man or the student to grasp the fact that money is always really nothing but a medium of exchange, like wampum, something to transfer property as a piping system transfers water. Money may defer real payments, but it must be got before it can be had and it does not pay a nation's debt unless it is bullion dug from the lands of the paying nation, then it is in its production, goods. Further, the goods given and the goods taken in exchange are of equal market value. Money merely enables our goods and labor to pay debts, to pay for other labor and other goods. The goods given and the goods taken tend to balance each other. Trade between nations does similarly balance eventually except for presents (including the funds of emigrants, bad debts and the losses through unsound investments) and is paid in the produce of the trading lands. This produce may be corn or cloth, coal, iron or gold from the mines, or it may be service in a hotel, a hospital or a ship. The point is that it is paid in the products of industry, and money has no more to do with it than would money in the following case. Ten farmers may compose a village. They have empty pockets, but each has $1,000 to his credit in a near-by bank. Some busy day they are animated to buy and

sell from each other, and by noon they have effected transactions among themselves to the extent of $25,000 worth of houses, lands, teams, and cattle and have given fifty bank checks on the $10,000 which has all the morning lain to their various credits in the bank. The bank checks furthermore had nothing more to do with it than so many figures on the bank-book keeper's ledger where they were finally totalled up. The farmers apparently paid with credit slips, but really they exchanged the results of toil. Nations do the same through highly organized and well-nigh invisible financial mechanism for international payment in which gold, except it be mine produce just entering circulation, renders the same service as the bank checks or the figures in the ledger above mentioned.

Other Factors That Enter Into the Settlement of Trade Balances.—The keepers of import and export statistics see but a part of the international transactions. There are other factors in international payments than mere import and export, such as the oft mentioned interest money, the expenses of travellers, the payments of international freights and the properties of emigrants who may be laborers with bundles of clothes or heiresses with millions in securities. The traveller is sometimes a weighty factor; as in Bermuda, for instance, which is thus enabled to import from three to four and one-half times as much value in goods as it exports, and in Switzerland where the traveller leaves over $10 per year for every inhabitant of the country.

The capitalists' or the heiresses' securities are still another confusing factor; if they are bonds they are deferred payments; if stocks which represent immediate ownership, an immediate transfer of title to property from one country to another is involved. In either case, the emigrated capitalist or heiress can become the actual user of wealth in a foreign land only through the transference of actual goods from the country where the property is, and the receipt of goods of equal value in the country where the owner lives. A British peeress' income of half a million dollars from bonds of a United States corn-belt railroad really means $500,000 worth of American wheat, corn, pork, or other produce sent abroad from America, for by that means only could the farmers who supported the railroad pay their freights from which the railroad company pays its interest. And unless

that $500,000 worth of goods or its equivalent reaches Britain, the owner is no more benefited than Crusoe would have been had he on his fertile isle possessed a similar fortune in bonds. A ship loaded with goods purchased with the proceeds of the bonds in the country where the property lay would enrich alike Crusoe on his isle and the heiress on her isle. They both need goods, not documents.

Payment in Goods and Promises of Goods.—Our complete commercial and financial organization has made it less visible but it is none the less true that when we go to Europe we pay our way with American goods or the proceeds thereof in government or bankers' promises to pay, while the goods go some other way. It is only in the visibility of the device that we differ from the Esquimaux who would come a pauper from his land of barter in the north unless he brought the furs and products which alone permit him to get our money to pay his way during his sojourn in our lands.

Beneath and behind the smooth-running machinery of international financial settlement with its bankers' cheques and bills of exchange, is the commodity settlement complicated by the traveller's payments and by the deferred payment of investments; but, with the exception of the transfer of wealth by the emigrant, which is a gift from nation to nation; there is a final balance in the exchanges of goods, or a promise to balance as shown by stocks, bonds, and financial promises. Bullion dug from a mine in the exporting country and entering circulation is here counted goods, because it is a product of industry and a bank note is not counted as goods because it is nothing more than a certificate or receipt for goods like a railroad ticket. This payment of goods, present and deferred, combines with normal industrial development to give us four stages in the evolution of the national trade balance which is the annual record of the movement of goods.

The Stages in the Evolution of a National Trade Balance.—(1) The first is the equipment stage, in which the people of a country are borrowing heavily from the people of some other country to get the means to equip their land for production. During this period the imports exceed the exports. (2) The second stage is the interest-paying stage, during which ordinary

wants of import consumption are paid for by exports and in addition other exports are sent out to pay interest, giving the interest-paying stage a surplus of exports over imports. (3) The third stage is the foreign-investment stage, during which the country is sending out food or materials for the building of factories, railroads and other equipment in other countries, still in the equipment stage. During this third stage also the exports are likely to exceed the imports. (4) The fourth and final stage is the interest-receiving stage and the return of investment stage when the loaning country is receiving interest payments in the form of produce and possibly occasional returns of principal. This makes the imports greatly exceed the exports.

The First—The Borrowing or Equipment Stage.—We can best understand the working of the first or equipment stage in its influence upon trade balances by taking a particular case. Some Americans with $10,000,000 to invest conclude that they will build a new railroad in Mexico. In the beginning of operations, a number of engineers, graduates of American technical schools, cross the Mexican boundary in a passenger train, promptly followed by many boxes of bacon, barrels of flour, and a miscellaneous assortment of provisions which the Mexican customs officials record as imports into Mexico. The line is surveyed and located, and work begins. Carloads of dynamite, trainloads of cement, hundreds of tons of steel girders, thousands of tons of steel rails, hundreds of miles of telegraph wire, millions of feet of lumber in the form of ties and station material, and carloads of provisions for construction camps cross the Mexican boundary and are credited as imports. If a number of similar operations go on at the same time; in other words, if Mexico were on something of a boom and foreign capitalists were busy investing there, it is unquestionably true that the imports would exceed the exports at this time. The pay for the Mexican workers who do the work of construction stimulates the import of consumption goods which indeed is the actual form in which it enters Mexico. Such is the normal condition of a country that is having a lively experience in the equipment stage of its industrial and financial history. We can see that this equipment stage, with its surplus of imports is, therefore, likely to occur in the most undeveloped regions and is really the beginning of participation in the world

of trade. It will take on added intensity whenever a country experiences a new industrial boom, as occurred in South Africa just after the South African War, in Cuba just after the Spanish-American War, and in Korea, where, after war with Russia, Japan took hold with a firm hand to govern, a strong broom to clean up, and foreign capital goods to develop, so that the trade for 1907 consisted of $8,000,000 exports and $20,000,000 imports.

Canada, especially western Canada, was at that time also, as is well known, experiencing a general industrial boom, and a tremendous development in railroad building. These new enterprises were financed quite largely by foreign countries, but the money went to Canada in the form of goods and showed itself in imports worth $351,000,000 while the exports were valued at $227,000,000. Germany, with colonies consisting of vast undeveloped areas, is making great efforts to build railroads and otherwise develop her territories. As a consequence her colonies imported $20,000,000 worth of produce in the year 1906 and exported $10,000,000 worth. Panama shows the most delightful example of all. It exists as a freight forwarder and as a kind of construction camp for the world's greatest piece of equipment now under construction, and, in consequence, imports almost five times as much as it exports. Any country with abundant and profitable resources but with little capital is liable to enter this first stage.

The wealth of emigrants, always a somewhat confusing factor, is especially so in this stage because of the proportionately greater number of people who transfer their whole fortunes to the new country, a transfer which takes place in the various forms of *goods* and is never paid back because the owner goes along.

The Second or Interest-paying Stage.—All this so-called unfavorable balance of trade for the new country looks upon the surface like loss for the nations which send out the goods without return. The people of the supplying country take the immediate return in the form of printed claims on property, usually stocks and bonds of the enterprises for which they have sent supplies. These are really promises to pay and the real return comes when the newly equipped enterprises make dividends and cause the country in which they are located to enter upon the second or interest-paying stage. If some persons

in Boston have spent $100,000 in equipping a copper property in Mexico, that property can only make returns on the investment by yielding copper and the copper can only make returns for the people of Boston by causing a certain value in goods to be shipped out of Mexico in such a way as to place those goods or their equivalent in money or other goods at the disposal of the Boston owners. If property in Mexico pays something to the owner in America, something must go out of Mexico to do it. This is a factor toward surplus of exports for Mexico. In addition, ordinary consumption goods are imported and paid for with other exports.

We see this interest-paying stage to best advantage in some rather mature countries whose statistics give us small reason to question their accuracy. Australia is well known to be a tremendous borrower from England, because the English have built and yet own most of the Australian railroads, hold many state and municipal bonds, and own many Australian sheep ranches, getting their returns in exports, which in 1907 amounted to $339,000,000 for all Australia, while the imports were valued at but $252,000,000. New Zealand with similar conditions exported $86,000,000 and imported $74,000,000 worth of produce. British India, which is almost exactly analogous to Australia in its dependence on foreign capital, exported $562,000,000 worth of products and received in return in the same year but $442,000,000. All of the remaining British colonies had a total export of $553,000,000 and an import of $526,000,000, giving to the entire British Colonial Empire an export excess or so-called favorable balance of trade of about $246,000,000. The Dutch East Indies are controlled to a surprising extent by Dutch enterprise, and the trade statistics show an unusually heavy balance with an export of $130,000,000—a figure 47 per cent. ahead of the imports of $88,000,000. Russia has been a notorious borrower and figures in foreign trade with exports of $564,000,000 and imports of $412,000,000.

The Third or Investing Stage.—The foreign investment stage is hard to single out, because the activities which place a country in this stage are likely to run side by side with those which characterize the second. The best illustration of this is to be found in the United States, where numberless corporation

managers are from time to time collecting vast amounts of cash for interest payments which they must annually make to the Europeans who hold the stocks of American railways, street railways, breweries and manufacturing enterprises. An interesting example of this is the reported instance of the late Queen of Spain, who, during the Spanish-American War, owned a large amount of American Steel & Wire Company's stock and kept it for safety in the Bank of England. While the United States is paying interest money out of the east door to Europe on these vast borrowings of the past, we are sending capital out of the north door, the west door and the south door. The American Consul General in Mexico reported recently that Americans had within a short period of time invested $500,000,000 in Mexican property. This process is continuing in Mexico, Canada, and in a number of other countries, so that this investment abroad joins with the payment of interest to capitalists of Europe to make our excess of exports over imports surprisingly large.

The Fourth or Income Receiving and Return of Investment Stage.—England has more than once been likened to an old gentleman with many money bags which he jealously guarded. Britain has led in the loaning of money to all equipping countries from New Zealand to Saskatchewan, from San Francisco to Cape Town. The enormous results of this now show in an import of $3,142,000,000 in the year 1907, which sum exceeds by more than a billion dollars the exports of $2,073,000,000. Germany also is no mean capitalist, as shown by imports of $2,081,000,000 and exports of but $1,629,000,000. France, Holland, and Belgium also belong in this same favored class of interest receivers, having the so-called unfavorable balance of trade which is really a sign of riches. As another explaining factor, the heavy disbursements of foreign travellers in Europe should not be lost sight of in this connection.

Many persons who are interested in and affected by the commercial policy of the United States seem to think that a country can go on forever sending out more goods than she gets and be better off for it. Yet those same persons would scarcely see wisdom and business soundness in eternally paying out more than they took in. This country is doing it now, because we are

at the same time paying debts and taking deferred payments for our exports in the form of foreign properties, such as Mexican, Ecuadorian and Chinese railways, Canadian lands, and Cuban orange groves and vegetable fields. But just as surely as that money put into these properties is well invested and the properties are sound, they will make returns and will make them in goods. Otherwise, the $10,000,000 of the gentlemen who built the Mexican railroad is gone. If you own a plantation in Cuba and live in the United States that plantation can be of no conceivable use to you in an economic sense, unless by sending out goods it enables you in the United States to have goods of some sort sent to you from somewhere; that means imports for the United States; that means a figure in the column of excess imports, the so-called unfavorable balance of trade. The only other possible way for that plantation to be of use to you is for you to go there, and there enjoy the goods which it produces. The inevitable result of safely made, heavy foreign investments upon the balance of trade is therefore to make the imports eventually exceed the exports unless the persons investing abroad emigrate with their money (goods) and live upon their foreign property and take its proceeds on the spot. If a country is willing to export both its capital and capitalists, it can indefinitely maintain a surplus of exports. This the Americans have no apparent intention of doing. Therefore, those who are making plans and legislation concerning our foreign trade must expect and prepare for a great increase of imports, if present normal developments of foreign investment continue as they almost inevitably must.

CHAPTER XVI

THE INFLUENCE OF GEOGRAPHIC FACTORS ON THE COMMERCIAL POLICY OF NATIONS

Every nation desires the greatest possible measure of independence. There are two kinds—freedom in government and self-supporting independence through variety of industries. Political independence is always menaced by industrial incompleteness and commercial dependence which a blockade may convert into starvation or humbling hardship to be ended by surrender to the blockading conqueror. As a result of this menace, all the nations of the world have some desire, or effort to establish or maintain the economic independence which alone is the strength to guarantee political independence.

This economic independence is attained by two means. First, varied industries which use domestic materials and approach completeness in the supply of national needs; and second, an unbreakable chain of commercial connections, which give access to the ports and products of the trading world and thus give through undisturbable trade the completeness of variety in goods that might arise from the home production resulting from the ownership of a rich continent.

Economic Independence through Control of the Sea.—Great Britain offers the one good example of the nation that has rightly felt independent because of the unbreakable commercial connections and resultant access to all markets and supplies. These have for decades been guaranteed by her policy of keeping a navy as large as the combined navies of any other two European powers. Unfortunately this method involves armed supremacy, and is only applicable to one nation at a time. The supremacy aspect of the situation is only of real value in war. During peace, when all may use the world's highway, the sea, the nations of the world have a close approach to equality in that economic completeness that comes through sea-borne commerce. It is completeness but it is not independence, for all the single lesser

nations know that it rests upon the good will of the owners of the stronger navies. But the great advantage of seaports and sea trade makes maritime outlets one of the greatest ambitions of nations.

Value of Access to the Sea.—Thus Russia has since the beginning of modern times striven seaward from inland Muscovy. When she finally reached the Baltic Sea, she promptly established her capital there. Not content with ports on the Black Sea, the White Sea and the cold Sakhalin Channel at the mouth of the Amur, she reached out also for the Arabian Sea, the Yellow Sea and the Sea of Japan, where she came into contact with Japan in the war of 1904.

Germany stands credited by most observers as casting envious eyes on Holland because this small neighbor possesses the mouths of the Rhine, Germany's greatest natural commercial outlet. Austria and Hungary are jealously developing their respective ports of Trieste and Fiume at the head of the Adriatic; and even friendly Canada laments that the frozen St. Lawrence makes her naturally dependent upon American Atlantic ports during the winter months. To avoid this dependence, the economically uncalled for Intercolonial Railroad has been built in great detour around Maine so that by this route through the snowy woods, Canada can, if need arises, reach the open sea at St. Johns, N. B., without crossing American soil. It is also claimed that Canada's good feeling toward England was greatly strained because the mother country acceded to a boundary decision that gave to the United States all the seacoast of Alaska.

Economic Independence through Varied Industry.—While sea power as an essential part of economic independence is limited to the nation with a dominant navy, any nation with powers of self defence by land, and land defence is relatively easy, may become independent by the development of varied industry supported within its own territory. This object dozens of nations are now attempting to attain by protective tariffs that cause the establishment of industries because they give a higher price to the manufacturer who produces and sells within the protected country. The same national end is occasionally sought through bounties on production. The geographic conditions in which nations are placed cause them to fare variously with their pro-

tective tariffs. They have reached a variety of situations in which it is possible to observe the recurrence of phenomena in a way that suggests laws of tariff evolution.

The British Tariff Development.—In tariff developments as in other industrial developments England has been a pioneer. There the factory system was first established, and at a time when a general protective tariff was levied on the products of the factory and the farm and the Napoleonic wars gave a rare opportunity for large sales abroad. Great growth of manufacturing resulted and with it great increase of city population. These city dwellers consumed more food than the English farms produced and the importation of grain that paid a high tariff made the price of food so high that great hardship resulted in cities through the high price of grain. This same high price made great prosperity for the land owners through the high rents that they could exact from the renting farmers. Then followed the historic corn law agitation, a strife between a landed aristocracy and the hungry city workers, resulting in the repeal of the tariff and the adoption of the free trade policy. This permitted the import of cheap food which ere long reduced the price of farm produce and greatly reduced British agriculture. It in no way injured her manufacturing interests because no other country had such supplies of coal, iron, capital, and skilled labor, and consequently there was no real manufacturing rival, except an isolated industry here and there like the silk industry of France.

This situation of British supremacy and resultant free trade continued unchanged for half a century, during which free trade rose in the English mind to the dignity of a virtue—a piece of accepted morality. The twentieth century saw this position challenged by a strong but unsuccessful agitation for some tariff protection for British manufactures. This resulted from the building up in the United States, Germany, and Belgium of factories that were as efficient as those of Britain. This foreign competition became the more acute because of the practice of "dumping" in the British market, at low prices, the unsalable surplus of factories in other countries. It is quite possible that England, like Canada, will arrange an adjustable tariff to check this practice of dumping.

German Tariff Development.—Germany has gone part of the ray through the course followed by England. Before her unification, Germany, with many little tariff units, was chopped up ıto a multitude of local trade units making large domestic trade npossible and causing the continuance of the household inustry that England had largely discarded in Napoleon's time. Inder a general protective tariff she has since 1870 developed great factory system and rapidly added to her agriculture great manufacturing industry. Her cities have grown like hose of the American West. Berlin has matched Chicago in ıe increase of population. As a result the city populations f Germany cannot be fed from the German fields, so that ıe protective tariff makes high priced food. The English sitution of 1840 is repeated in almost every detail. The corn ıw fight is on. The German nation of 65 million eats costly read and meat and the aristocratic landholders, estimated by ne authority[1] at 300,000 persons, profit by the resulting high ents. The nation also has the advantage of having a large share f its population living under the better conditions of the country, ut the German artisans, like their English fellows of 1845, will ırely repeal that tariff and get cheaper food before many years r decades have passed. The landed aristocracy is now slowly sing ground in the contest with the landless millions, and nly holds its own by a voting system based on a mediæval class ominance.

Holland and Belgium, too weak to be naval powers, too small have widely varied industries, or many raw materials, and o populous to feed themselves, have low tariffs, approaching ee trade, in food, raw materials and manufactures. No other olicy seems possible to them. A tariff at any point would mbarrass some industry unless levied upon a pure exotic, and then becomes a mere revenue measure like the English tariff n tobacco.

Tariff Development in the United States.—The United States , of all nations in the Western World, best fitted for ecoomic independence through a wealth and variety of natural sources permitting an almost completely satisfying variety production. The Americans have been but a handful, riot-

[1] See *Forum*, September, 1901.

ing in the richest abundance of resources to which the hand of man was ever laid. We have been large producers of all important foods and raw materials except rubber and tin, while our supply of cotton, tobacco, petroleum and copper almost verges on monopoly. On this basis of opportunity the protective tariff of the Civil War, laid first as a war measure, produced prompt and surprising growth of manufactures. The protective tariff was then continued as an industrial measure, our factories throve tremendously with the aid of imported labor, and for some decades the United States has been pointed out as the most conspicuous success in the attainment of national independence through varied industry stimulated by the protective tariff. It is probable that there has been a general under appreciation of the part that wealth of resources has played in this development.

Within the United States the different sections of the country have furnished an interesting but easily explained medley of opinions on the tariff. New England has wanted a tariff on cloth and shoes to protect her textile mills and shoe factories, but she has wanted no tariff on the raw material, wool and leather, which she did not produce. The wool growers of Ohio have wanted, and generally succeeded in getting, a tariff on raw wool, while the cattle-producing states have desired tariff on hides. Massachusetts, a coal buyer, has wanted no tariff on coal that she might get it cheaply by boat from Nova Scotia or Wales, while Pennsylvania, a coal producer, has held stoutly for a tariff on coal. Some southern states, exporters of cotton in which they had no rival, and importers of nearly all manufactures, have been thorough free traders until the lumber industry sprang up within their borders, and then their congressmen voted for a tariff on lumber. Many other examples of the origins and changes of tariff attitude in the various sections of the United States might be shown to follow closely upon industrial condition and industrial change.

We have attained our rapid distinction in manufacture while the nation is still an exporter of food and raw materials. As to stage of evolution of tariff policy we are still far behind Germany, although there are signs that we are beginning to approach her condition. While not importing much food, we are using an

increasing amount of imported raw material and the cry of "free raw materials" that is now heard is the first symptom of the approach of the American counterpart to the so-called agrarian question in Germany and the corn law agitation in England. If the United States begins regularly to import wheat the tariff question will assume a new intensity through the class conflict between the rural wheat grower and the urban wheat user.

The Orient furnishes two admirable examples of the influence of geographic conditions on national policy in fields other than the tariff.

The Chinese Policy of Isolation.—China has persisted in ignoring foreign nations to the great mystification of many Westerners. "Let us alone," was China's expressed sentiment toward all peoples. She was often considered benighted but her policy was probably wise and it was certainly of natural origin. There was little that the world could give her because she was a world in herself. The summer rains of China stimulated agriculture, which availed itself of rich alluvial plains near the sea, while in the north were extensive deposits of fertile Loess, the most indestructible of all upland soils. Reaching from the latitude of Havana to that of Newfoundland, her forests ranged from bamboo and oranges, to pine and spruce; her grains from rice to wheat, corn, millet, barley and rye. In the south was cotton; in the center, silk; in the north and west, the wool and hides from the flocks that roamed the 2 million square miles of arid and semi-arid ranges in the provinces. The mines yielded iron, copper, gold, and silver. The careful husbandmen raised pigs and poultry in vast quantities and the fish supply of sea and river was supplemented by fish culture in which the Chinese have led the world. From north to south the grand canal passed between the latitudes of northern Florida and Philadelphia and connected a set of inland waterways probably better and more used than those of any contemporary nation of 1800 or 1850. While the domestic system of manufacturing continued in both East and West, the West had little for China but silver. In 1819 a British publicist lamented the fact that America had in the furs and ginseng of the forest the only commodities except bullion that the Chinese would take in pay for tea which the west desired, and which the western merchants

took over the junk side in the Chinese harbors. Naturally China wanted to be let alone by those who had nothing for her. The discovery of petroleum and the invention of machinery, both of which China needs, have given to that country the desire for imports, the basis for a foreign trade, and following that a foreign policy. Along with a foreign policy comes the development of a national sentiment in which China is making great progress. Chinese students now in American universities did not when in school at home know there was such a thing as China. They knew of their own town or district, and the province, but the term China meant no more than Asia. Out of this chaos, the new economic conditions are raising a new concept, *China*, just as the concept United States rose out of separated colonies and finally in the railroad epoch became United States *is* rather than United States *are*—a grammatical record of a profound change in sentiment made possible by communication.

Japan Becomes a Manufacturing Nation.—Japan furnishes the second Oriental example of geographic influence upon policy. Like China she had for centuries lived within herself supported by agriculture and household industry. As she approached the limit of possibilities in that direction, western ships visited her shores. Her insular location made easy the infiltration of foreign ideas and foreign goods which her meager resources caused her to desire to import. Japan adopted western learning and western machinery and was seized with the ambition to be a world power. This required armies, navies, arms, railroads, and the mechanical equipment of the inventive west. In the attempt to equip herself with these things Japan realized her poverty, which was intense alike if she would buy or manufacture at home. Her dense and diligent population could not wring a surplus from the scanty land. There was no surplus of rice, and it is now regularly imported, as are also flour, beans, tobacco, and most of the little meat that they eat, and even phosphate with which they fertilize the fields. To complete the list of her limitations we need but to point out the poverty of factory materials. There is no wool or leather, but little cotton, no rubber, no iron, and inferior supplies of coal. Yet the increasing population of Japan must support itself by manufacture, or emigrate, or starve. There were no suitable places for extensive emigration, so the demand for manufac-

turing and the trade in raw materials and finished products was imperative.

Japan Becomes Possessed of Colonies.—As the Japanese realized that they must become like England and live by manufacturing, they appreciated the importance to themselves of Korea and Manchuria. They had long imported from these quarters beans, bean oil, and bean cake (for fertilizer), and the trade with these regions promised to be of prime and increasing importance as the country went over to the factory and commercial basis. Korea had unused rice and barley land, promising minerals, and good forests. In Manchuria, corresponding to our upper Mississippi valley and part of the Canadian Northwest, is the finest stretch of unused farm land in the Mongolian world. Manchuria also has forests, coal, and other minerals. These regions would furnish Japan with food, take her manufactures and the thronging emigrants, and would put her in an independent position resembling that of China and the United States.

Japan's war with China in 1893–94 was little more than a necessary expedition of conquest, and the conquest was provided for in the treaty of peace. Then a coalition of European powers took from her the fruits of the war and handed over to Russia, Port Arthur and the railway, that modern burrowing root of the tree of conquest. Japan, landless, crowded, threatened with suffocation, prepared herself for mortal combat as probably no nation ever did, and when Russia laid hands on Korea, she sprang and fought, and to the profound astonishment of the world, won for a second time the possibility of a large part of that economic independence which has enabled China to scorn the world and has made the United States to be unique among the nations.

In the desire for an acquisition of a colonial empire, Japan is by no means unique, she is merely late. Most of the other powers have had colonies or the desire for them for many decades.

The Reason for Colonial Possessions.—Despite many philanthropic protestations, the commonest working theory of colonies is the same as that which causes the imposition of protective tariffs to reserve the home market to the home manufacturer. The colony merely enlarges the home market idea through the agency of some arrangement whereby the enterprisers of the home country have advantage over foreigners in availing them-

selves of the economic opportunities created by the colonies. Chief among these devices to attain special privileges are preferential tariffs, concessions of lands and other resources, favorable franchises to corporations, and favorable navigation laws.

The dominant idea back of the acquisition of colonies is the securing of markets. Owing to the instinct for national completeness men sacrifice the known mutual advantages of trade, for every nation is glad to sell and chary of buying. Selling abroad is almost always regarded as an economic virtue for a nation. At the same time it is a corresponding or greater virtue to supply wants at home. Abundant selling and meager buying is the impossible and contradictory ideal for which most nations strive. Owing to this preference it is easy for any people to buy but often difficult for the people of one nation to sell to those of another. Hence the strife for foreign markets which can be made absolutely secure only by possession. Hence the international scramble for colonies which has caused so many wars in these last two centuries and has resulted in the loss of independence for nearly all of Asia and the speedy partition of Africa—the last free land for the colony grabbers. No publicist doubts that the Monroe Doctrine is the only force that has for decades prevented the partitioning among the market monopolizing powers of Europe of all that part of the New World south of the United States.

If nations put no more obstructions in the way of the individual's buying than they put in the way of his selling, and gave all individuals an equal opportunity to develop resources, the desire for colonies would largely die, and the map of the world would look very different from that which now exists. Nations would actually be trying to persuade each other to take possession of certain unruly peoples and give good government and hence permit the creation of commerce for all to share. Such a millenial dream is very far from the existing world condition of rivalry, and oftentimes of jealousy and threatened war among colonial powers.

Japan, like the United States, was very late in having any desire for colonies. Japan had first to abandon the domestic system before she realized any need for markets and colonies, but she then needed them more acutely than any other nation ever needed them, and she accordingly changed her policy with the

most astonishing rapidity. In a very short time she became possessed of colonies, the desire for which is a psychological and political response to the economic fact that a nation has emigrating people who need homes or manufactures for which she desires markets, or both.

One of the most interesting aspects of international relations is the complex of activity and the maze of fictions and pretenses by which nations express and often try to hide the desire for colonies.

The Process of Acquiring Colonies.—The way nations impelled by these forces gradually absorb weak countries is well illustrated by the fate of North Africa. In 1840 France sent an armed force into Algeria (Turkish territory) to protect her missionaries and from that foothold her power has extended until she owns Algeria and Tunis, although Turkey still nominally claims them. Egypt is still nominally a part of the Turkish Empire, but out of the franchise to build the Suez Canal came a French and British influence that has now resulted in the practical rule of Egypt by a British agent and a British army.

In 1904, France and England arrived at an agreement (entente cordiale) concerning Spheres of Influence in the Mediterranean. France agreed to give England a free hand in Egyptian affairs in return for surrender by England of any exclusive interests in the western Mediterranean. Since 1840 France had been gradually extending her control in north Africa until she had absorbed Algeria, Tunis, the Sahara, much of Soudan and was far on the way toward an absorption of Morocco through the extension of influence over customs, police and banking. The removal of England left Morocco apparently to the mercy of France and Spain. Spain had for centuries held a few towns opposite Gibraltar. In 1905, Germany interfered, alleging that France was aiming at commercial monopoly in Morocco. As a pretext for German interference, German subjects had concessions to build certain public works, especially a mole in Tangiers. She demanded that an international conference be held to determine the status of Morocco. Members of this conference, held at Algeciras, Spain, were England, France, Spain, Germany, Austria-Hungary, Italy, Belgium, Netherlands, Portugal, Russia, Sweden, Morocco, and the United States.

This is the full list of the Caucasian Colonial powers plus Sweden. After long conference the demand of Germany for a share in control of Moroccan affairs was not granted. The police of the country were placed in French and Spanish control, as were also the finances, and the reduction of Morocco went on with quicker pace in the campaigns that were promptly waged against her disorderly tribes. Within five years after the Algeciras conference the right of France and Spain to partition Morocco was recognized by treaty. The Mohammedan tribes will make it a task of many costly campaigns.

This brief account of the passing of north Africa from independence is typical of the modern process of Colonial acquisition where there is not enough land to go around. Middle Africa with its many ignorant, unorganized and weak tribes was merely parcelled off by the nations as town lots might be parcelled by a syndicate of purchasers—England, France, Germany, Austria, Italy, and Spain, each taking a piece.

The most refined methods of annexation are through loans and railways. The weak nation borrows, and the interest is not paid. The lender takes possession of the custom houses to collect the interest on the debt and it is very easy for custom house control to spread to the control of the towns and then the country. Thus the United States became the dominant force in San Domingo by common consent when Europe threatened to do it if we did not. By the railway conquest, the undeveloped nation agrees that a railway shall be built in its territory by representatives of some more powerful nation. Such were the Russian railways, across Manchuria to Vladivostok and to Port Arthur. The railways and the workers thereon required protection. The difference between police protection and an army is a line that has never been pointed out and Russian soldiers in great multitudes entered Manchuria, which the whole world recognized in a few years as essentially a Russian province, as Egypt is an English province, despite the sovereign claims of an ornate Khedive in Cairo and a despotic Sultan in Constantinople. By the War of 1904 Japan took the rights to some of the Manchurian railways from Russia by force. China was no less dismembered by the change in concessionaires who were really conquerors.

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